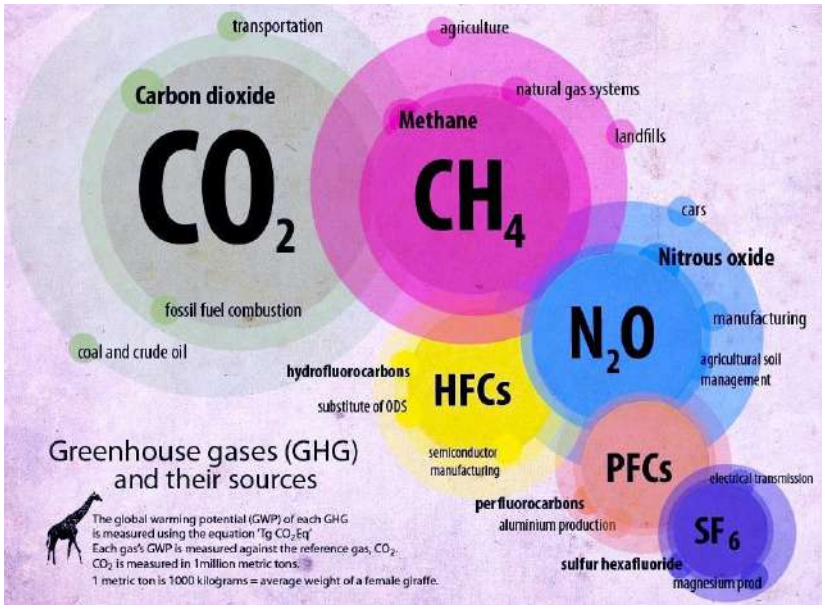
## Our Renewable Energy Future

For centuries, humans have relied on geologic natural resources from fossil fuels to power our lives. Fossil fuels are deposits of ancient sunlight that were harnessed by photosynthesis in shallow seas by cyanobacteria and phytoplankton, as well as in terrestrial swamps and forests by mighty ferns and trees. The potential energy is stored in the complex bonds of hydrocarbon molecules in the fossil fuel deposits. The result is that we are able to convert chemical potential energy from a black rock like coal into an electrical energy that can do things like heat our water or charge your cell phone! This process requires an exothermic reaction like combustion to release the store chemical potential energy within the coal, oil, or natural gas which in turn emits pollutants like soot, smoke, and $CO_2$ (carbon dioxide).




Greenhouse gasses like $CO_2$, CO, and $N_2O$ are byproducts of combustion from cars and manufacturing. As we learn more about global warming's effects on communities around the planet, we see the immediate need to reduce our fossil fuel dependence.

Since fossil fuels are mined from the Earth and not produced in real time, we call them non-renewable resources. They are finite and will eventually run out. In currently active mines, it is estimated that the U.S. has about 25 years of coal supply left, with 470 years-worth still in recoverable deposits. Many sources opine that we have about 50 years of extractable petroleum left, but there is disagreement on this number. There are many factors related to extracting the oil that affect this value. To learn more about this debate, check out this short lecture by David Keith, professor of Applied Physics at Harvard University, click HarvardX .

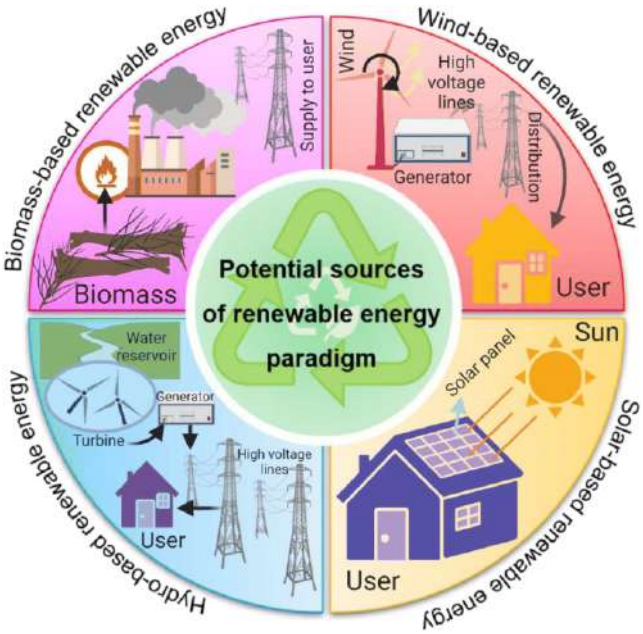
In order to reduce heat trapping carbon emissions and move to a more resilient energy future, nations around the world have set goals for reducing fossil fuel use and decarbonizing their energy systems (read about Volkswagen's decarbonization efforts). The world is shifting away from non-renewable fuel sources to renewable energy technologies that are generated more locally and are more climate friendly. Our 2022 summer assignment explores some of these technologies and their deployment right here in Virginia, looking into our local energy future and become better informed.

**Renewable energy is here and now in Virginia!**

The electronic version of the summer assignment can be found here: https://cbgs.k12.va.us/students/reading-lists/

## I. What is Renewable Energy?

Energy that is replenished on a real-time basis, like when the sun shines, the wind blows, or the tide turns, is considered renewable. These forms of energy are virtually inexhaustible because they come from basic Earth processes in real time, so you can never run out over the long haul. While they may be inexhaustible, they are not unlimited. There is a finite amount of energy that can be harvested on any given day, because the total amount of energy is limited per unit of time. Let's start in by watching: [National Geographic-Climate-101-renewable-energy/.]




**Assignment Instructions:** *Either electronically or on paper, create a new document, copy the questions, and then answer them for both Parts 1 and 2. Please be thoughtful and complete in your answers, using examples from the learning, writing meaningful and well-crafted sentences. Remember to check your spelling and grammar, and turn in your best work.*
*This assignment is due the first day of CBGS classes when you return from summer break.*

Now let's consider the different types and sources of renewable energy. Go to the link at Virginia Energy Sense and read about the different types of energy available in the Commonwealth and answer the questions.
Read: https://www.virginiaenergysense.org/energy-101/renewable-energy/

**Part I. Questions:**

1. Of the renewable energy sources discussed in the reading (solar, wind, geothermal, hydroelectric and biofuel) which are you the most interested in? What features of this particular energy production method do you find the most promising or important to Virginia's energy future?

2. What is "net energy metering"? Research this idea and explain basically how it works.
Do you think net metering will help encourage people to convert to renewable energy? Why?

**Part II. Understanding Renewables and Capacity in Virginia**

In the Commonwealth, we have many promising renewable energy sources we can tap into. Much is already invested into solar energy and biofuels, while wind energy is catching up fast. For this part of our learning, choose an energy resource that you would like to learn more about: wind, solar, biofuel, or energy storage. Each of these topics have a list of videos and readings. Choose your topic and complete all of the learning for that section, as well as answering the questions. You will submit your answers to your Foundations teacher, and you will share your thoughts and learning in classroom discussions when we return to school.

**Part II. Questions:**

3. In a paragraph, describe the renewable topic you chose and explain how it works in your own words.
4. What aspects of the renewable that you chose are the most interesting or promising to you? Based on what you have learned, how likely is it that this power source will become a significant part of our lives in the future?
5. On your own, do some research on your renewable choice- what are some of the perceived downsides of this power source? What negative aspects of this renewable might affect its adoption? How would you compare the negative for the renewable to the negative aspects of the non-renewable fossil fuel alternative?
6. Last, what are three questions that you have related to your learning on fossil fuels that you can bring to class when we return? Ideas: What more would you like to learn? What concerns might you have with adopting a new energy system or what interesting applications might be on the horizon for this fuel source?

**Offshore Wind**

Watch: Energy 101: Wind Power

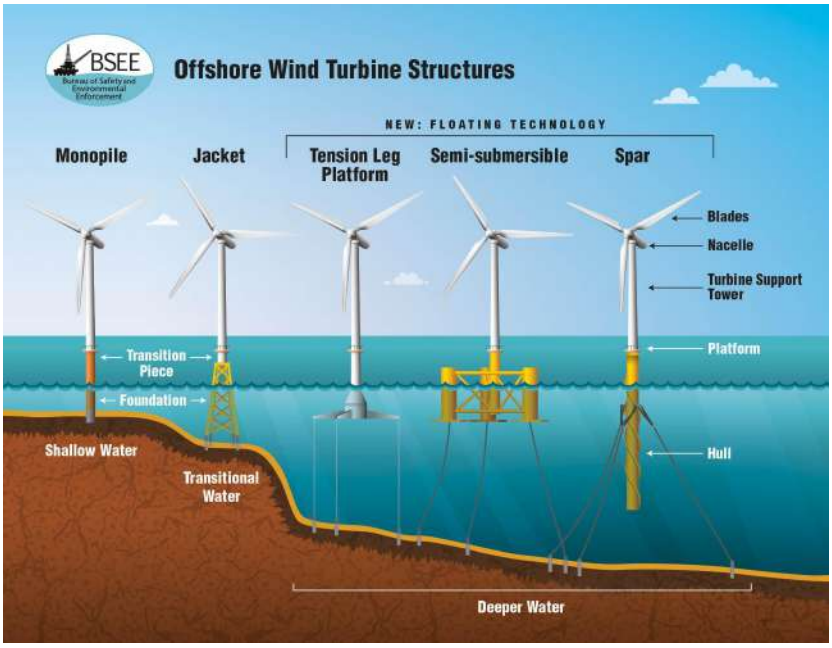
Watch: Off-Shore Wind Farms Provide Promising Roadmap For More Clean Energy

Coastal VA WInd- Dominion

Read:

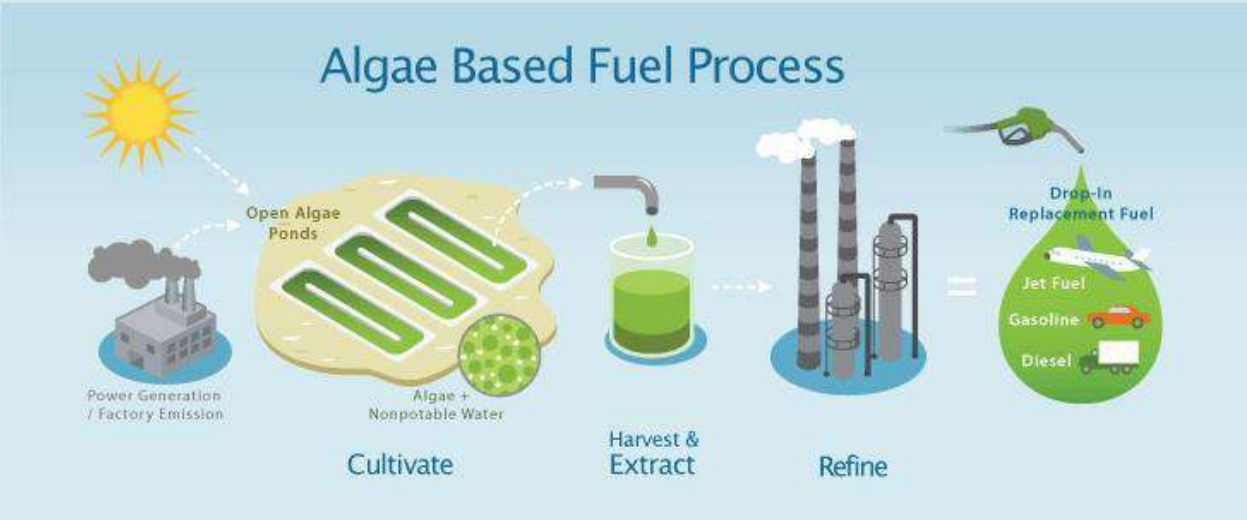
https://www.reuters.com/business/energy/dominion-siemens-gamesa-plan-virginia-offshore-wind-power-hub-2021-10-25/

Read: https://coastalvawind.com/about-offshore-wind/delivering-wind-power.aspx - sec3



Summer Assignment: Chesapeake Bay Governor's School for Marine and Environmental Science

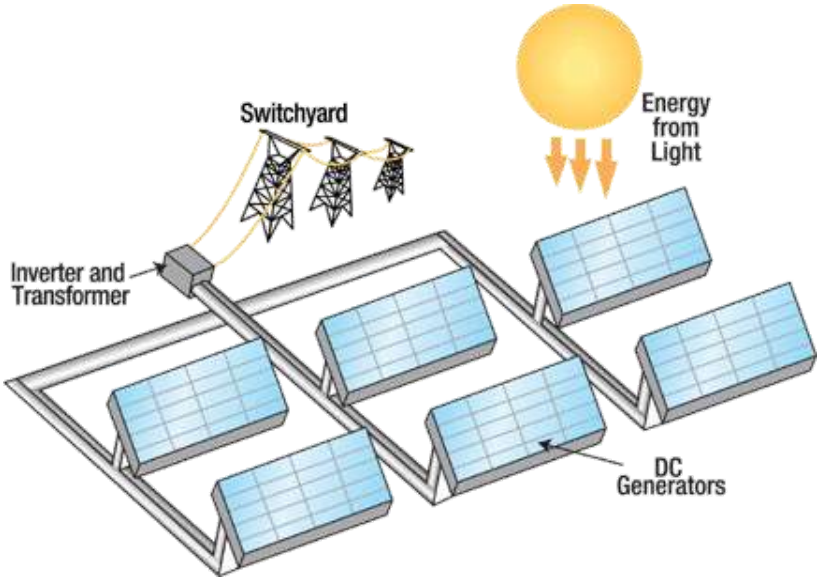
**BioFuels**




Watch Dept of Energy- Biofuels
Watch: https://www.energy.gov/eere/videos/energy-101-algae-fuel
Watch: https://www.nrel.gov/bioenergy/algal-biofuels.html
Read https://www.energy.gov/eere/articles/bioenergy-renewable-sustainable-attainable
Read/view PowerPoint: https://www.resilientvirginia.org/
Read: VT- Renewables/biofuels
Check out: NREL-biofuels-atlas

**Solar Power**

Read Science news for students – let's learn about solar power
Watch TED ED- How do solar panels work?
Read Middlesex Solar Power https://suntribesolar.com/case-study/middlesex-virginia-solar-school/
Read Westmoreland Solar Power
https://rivercountrynews.com/westmoreland-county-public-schools-go-solar-p4654-574.htm
Read Virginia debates impacts of solar panels on stormwater runoff



**Fuel Cells and Energy Storage**

Watch: Energy 101: Fuel Cells

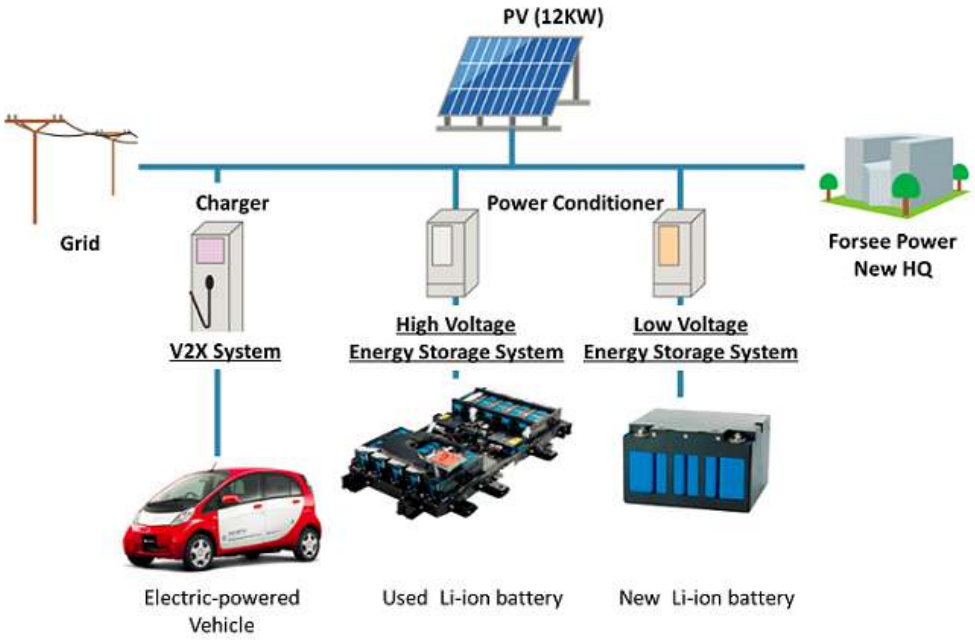
Watch: Tesla is Expanding Megapack Battery Energy Storage

Read: Dept of Energy- How do batteries work?

Read: what-is-battery-storage?

Read: Yale 360- Boost-for-renewables-grid-scale-battery-storage-is-on-the-rise

Read: https://www.nrel.gov/research/eds-hydrogen.html




**More Resources:**

The National Renewable Energy Laboratory

https://vept.energy.vt.edu/renewables/biofuels/biofuels_link.html

https://www.eia.gov/state/?sid=VA#tabs-3

**Works Cited:**

Nazir, M.S., Ali, Z.M., Bilal, M. *et al.* Environmental impacts and risk factors of renewable energy paradigm—a review. *Environ Sci Pollut Res* **27,** 33516–33526 (2020). https://doi.org/10.1007/s11356-020-09751-8