PORTSMOUTH MIDDLE SCHOOL

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received 5/2/22

April 22nd, 2022 (Earth Day)

Dear Mayor McEachern:

My name is Chris Rose and I am an 8th grade science teacher "down the hill" at Portsmouth Middle School. My fellow 8th grade science teacher and I use Project Based Learning in our classrooms and one of our recent content units was climate change; in particular, the human impact on the accelerated changes the planet has been experiencing for the last 60+ years. The guiding question for the unit was "how can you use your understanding of human-induced climate change and electricity generation to provide an energy solution that will help make Portsmouth more sustainable within the next 30 years."

Enclosed are seven of the most impactful energy proposals that the 8th grade students developed for our city. There were so many creative solutions provided by the 8th graders, but these included stood out as the most thoughtful and implementable for our coastal city. My students asked that I share the ideas with our elected officials. They did not think the project would have actual results in terms of Portsmouth's investments to reduce the worst impacts of climate change if we do not change our energy systems. I hope that these "mock" proposals will show that our young people care deeply about the climate change problem and have viable ideas of how our city can invest in alternative energy in the future.

Thank you in advance for taking the time to read through these exceptional solutions to the changing planet that we must all prepare to adapt to. If you have any questions or feedback for my 8th grade students, please do not hesitate to contact me at crose@sau52.org.

Sincerely,

Chris Rose
8th Grade Science Teacher
crose@sau52.org

Renewable Energy Proposal - 2030
City of Portsmouth
Prepared by: Maddie Ball
April 1, 2022

Climate change has been a problem since the 1960s. However, climate change was first predicted by a Swedish scientist in 1896. Svante Arrhenius had predicted that changes in atmospheric carbon dioxide could substantially change the surface temperature through the greenhouse effect. About 40 years later, in 1938, Guy Callender connected carbon dioxide increases in Earth's atmosphere due to global warming. Both of them were right. Almost 20 years later, in the late 1950s, some CO2 readings would offer some of the first data to corroborate the global warming theory. In the 1980s, scientists started to test the "theory" about climate change even more than before. In 2007 the United Nations finally started to show some concern for climate change and made it one of their priorities. Even though they stated it as a priority, they have not done anything significant to help stop climate change. The United Nations did give Leonardo DiCaprio the honor to help speak about the issues that climate change has caused as the U.N. Messenger of Peace. You can see part of his speech in DiCaprio's documentary "Before The Flood."

"Before The Flood" is a documentary where Leonardo DiCaprio visits five continents and the Arctic to learn more about the effect of climate change with scientists. In this documentary, DiCaprio visits New York, The Arctic Circle, Canada, Florida, China, India, South Pacific Island, Bahamas, Indonesia, South America, Utah, France, Washington, DC, and Italy. At each place, he speaks to someone about a particular problem their state, country, or continent, in general, is struggling with due to climate change. This documentary taught me how politicians are not doing anything, how other countries are struggling, and how the U.S. is causing many problems for other countries around the world. "Before The Flood" also teaches you how CO2 is the leading cause of climate change.

CO2, also known as carbon dioxide, naturally occurs in Earth's atmosphere as a trace gas. Plants breathe in carbon dioxide from the atmosphere during photosynthesis. When CO2 started to increase these plants couldn't breathe in all this extra CO2. Fossil fuels also have a vast impact surrounding CO2. Fossil Fuels are hydrocarbon-containing materials underground. Humans extract these materials and burn them to release energy for use. The primary fossil fuels are coal, petroleum, and natural gas. The U.S.'s electricity is produced by 60.8% of fossil fuels. Only 20.1% of renewable energy gets used in the U.S. When it comes to electricity usage, the U.S. will use 4.12 trillion kilowatthours (kWh) of electricity in 2021. Fossil fuels burn CO2 because fossil fuels mainly consist of carbon and hydrogen. When fossil fuels get combusted, oxygen combines with carbon to form CO2 and the hydrogen that forms H2O. These reactions release heat, which gets used for energy. About 44% of New Hampshire's electricity comes from fossil fuels. As of 2016, only 17% of electricity comes from renewable energy. That only supplies one-fifth of the electricity of the population of New Hampshire.

Climate change can impact Portsmouth by rising temperatures. We get all different kinds of temperature levels during the year because N.H. is halfway between the North Pole and the Equator. It is cool in the spring and fall, hot in the summer, and cold in the winter. Now with climate change, the weather has changed. Sometimes we never get snow during the winter. It gets hotter during the summer and even the spring. This is not average weather for a place that is halfway in between the North Pole and the Equator. If climate change keeps getting worse, the average annual air temperature in New Hampshire will increase to 90°F. Warmer summers increase the temperature in some coldwater streams. Climate change has made spring arrive earlier and brought more precipitation. Heavy rainstorms are more frequent than usual. In only a

century, the temperature of N.H. has risen by 2 or 3 degrees. (°F) The summers have been hotter and drier. If we do not try and change the way we get our electricity, then future generations will have to deal with problems they did not cause.

There are five primary renewable energy sources: Wind, Solar, Tidal, Biomass, and Hydropower energy. Out of those five sources, I chose solar energy. *Solar energy* is the energy given off by the sun's rays. The amount of sunlight that strikes the Earth's surface in an hour and a half is enough to handle the entire world's energy consumption for a whole year. This energy from the sun then gets converted into thermal or electrical energy. This energy gets converted through photovoltaic panels. (PV) PV is when the sun shines onto a solar panel; energy from the sunlight then gets absorbed by the PV cells in the panel. This energy then creates electric charges that move in response to internal electric fields in the cell, causing electricity to flow. Portsmouth would use this energy for electricity. Solar radiation light is also known as electromagnetic radiation emitted by the sun. When it comes to solar-thermal energy, (CSP) systems use mirrors to reflect and concentrate sunlight onto receivers that collect solar energy and convert it into heat. The heat can then be used to produce electricity or stored for later use. These systems do not just end with PV and CSP. These should be integrated into homes, businesses, and existing electrical grids with varying mixtures of traditional and other renewable energy sources.

New Hampshire only used 52 megawatts of solar energy in 2016. Out of the 19% of renewable energy used in New Hampshire, only 2.8% is solar energy. I specifically want to put solar panels on awnings or rooftops of 10 restaurants in Portsmouth. These ten restaurants are River House, Lazy Jacks, Old Ferry Landing, Rooftop At Envio, Surf, Martingale Wharf, The Oar House, Popovers, Beach Plum, and Botanica Restaurant and Gin Bar. I hope that these solar panels can produce energy for all restaurants so that they do not have to rely on fossil fuels for their electricity. We will probably have to take it slow at first and slowly get these restaurants only on solar energy, but once we can ultimately have the energy converted to solar, we will be increasing the amount of solar energy that Portsmouth is using. When worrying about future snowstorms impacting the use of solar panels, there is no need to worry. To clarify, some of these restaurants are only open in the summer. For the other restaurants that are open during the winter months when it gets cold, the solar panels will work just as well as in the warmer months. Solar panels still thrive in cold weather. Solar energy is cleaner than fossil fuels because it is emission-free. Unlike coal and natural gas, solar energy does not release harmful pollutants or greenhouse gas emissions into the air and water supply. This means that using solar energy will help decline the increase of CO_2 in the atmosphere of the air.

When it comes to solutions around the world, China and France are two countries implementing solar energy in their countries. China hopes to build 450 gigawatts of solar energy in the Gobi desert by 2030. That is twice the amount of solar energy currently used in the USA. Using solar energy would be a substantial economic boost for China, but it would also help Asia's environment. Southern France has just made Europe's first-ever solar-powered restaurant. Le Présage is using the sun's energy to run their restaurant. They use solar ovens and Scheffler mirror to make their food. A *Scheffler mirror* is a large parabolic dish that reflects and concentrates the sun's rays to heat a stove to 400°C. (752°F) This restaurant's kitchen water is currently getting heated by the sun. They plan on using biogas too. They want to turn their organic waste into gas. The solar panels will help chefs work on cloudy days and after sunset. Not only that, they want to turn the biogas residues into fertilizer for their garden, where the restaurant gets most of its vegetables and fruit.

The impact of these efforts is excellent. These solar panels will become one of China's most significant resources for decarbonization. Not only that but putting solar panels in the Gobi desert will bump their percent of renewable energy usage to 25%. That makes China the leading country in solar energy consumption. Le Présage is an excellent example of what I hope putting solar panels on our restaurants will help do. Le Présage hopes to open similar restaurants around France. The project will be an estimated €1.8 million—almost 2 million in American dollars. Le Présage is lowering the carbon footprint every day, and that is what I hope Portsmouth will be able to accomplish by 2030. Google Earth Project.

There will be negative impacts when it comes to using renewable energy. Portsmouth might face some challenges when implementing solar panels for restaurants, which can be when the solar panels cannot produce enough energy for the restaurant. This problem would usually be because of a lack of sunlight. Portsmouth does experience some days where it is cloudy and gray outside. When these restaurants are open during that day, they might have to use fossil fuels to get their energy. Another problem is when restaurants are open when the sun has gone down. Usually, a restaurant in the summer is closed right before the sun goes down, but in winter, the sun goes down before some of these restaurants close. With the sun, not present, the solar panels can not produce enough energy. Another obvious problem is the financial cost of this project. Solar panels are not the most expensive kind of renewable energy around, but they are more expensive than using fossil fuels. It will be worth the cost, but it would cost around... to put solar panels on only one restaurant. The shipping of these solar panels and having professionals put solar panels on the restaurants' roofs or awnings will also cost a lot.

Furthermore, another issue would be micro-cracks. Micro-cracks are a common issue for solar panels, and sporadic weather changes usually cause this. The weather changes significantly in Portsmouth, making this problem more common than usual. A final problem that Portsmouth might face is delamination and internal corrosion. This is when moisture gets into the panel itself. While this issue can be easily avoided, this will most likely happen because of where we live. With all the rain we get, it definitely might cause this problem. Although most of these problems can be resolved, they could be setbacks for this project.

Even with all these challenges using these solar panels will be worth it. Imagine how good Portsmouth will look to other towns when people hear what we are doing to help stop climate change. Tourists will be impressed that Portsmouth is eco-friendly. Furthermore, the restaurants will get more business. Portsmouth needs good restaurants considering the number of tourists that come. These restaurants having solar panels as energy use will impress everyone and increase these restaurants' businesses. It also really helps by saving money on energy bills. Not only will our town be eco-friendly, but these restaurants will be saving money that could go to something better like renovations and different foods so they could extend their menus. Finally, using solar energy instead of fossil fuels for electricity shows how humans are to blame for most of the effects of climate change. These restaurants' websites would probably include how they are trying to stop the effects of climate change using solar panels—considering that when we keep going into these restaurants and giving them business while they use fossil fuels for their electricity, it is our fault that CO_2 levels are rising. If we show our support for renewable energy, Portsmouth will get a lot more business.

Portsmouth should implement this renewable energy proposal by 2030 because of its importance for the environment and future generations. Climate change has caused irreversible damage to this planet. Forest fires cause animals' habitats to disappear, and some transportation releases CO_2. We are overpopulating our planet, causing more need for fossil fuels, which causes more CO_2 in the air and causes animals to become endangered. Our food chain is disappearing slowly. I want the United States to try to do something about climate change. I want New Hampshire to be one of the biggest states to help the issues we are facing. This is why solar energy will help decrease the effects of climate change. This idea will not magically make climate change disappear. No idea will reverse climate change, but that does not mean we cannot help stop the effects from getting worse. We can take this idea slowly, considering that ten restaurants are a lot and the time and effort would be a huge commitment, but it would be worth every penny. My generation is making climate change worse, but we did not cause this. Older generations caused the start of climate change, and now older people do not want to do anything about it. Yes, a good chunk of people over the age of 35 are trying to do something, but let us be honest, I see more and more younger people talking about this crisis. What younger people lack, though, compared to older generations is that we do not have the authority that older people do to help get our ideas and goals come to life. It takes us a lot longer.

Renewable Energy Proposal - 2030
City of Portsmouth
Prepared by Luci DiMeco and Lily Patterson
April 1, 2022

As humans we have burned 4,000 times the amount of fossil fuels as we did in 1776. But that wasn't always the case! We now use fossil fuels in many ways, especially starting during the industrial revolution. Cars now have combustion engines which burn fossil fuels which we didnt do in the past years when we were still modernizing our world. We also burn fossil fuels when we use things like heating, transportation (again), generating electricity, and creating common products like computers, cosmetics, paint, and household appliances. Fossil fuels release large amounts of carbon dioxide, a greenhouse gas, into the air. Greenhouse gasses trap heat in our atmosphere, causing global warming. Some other effects we are seeing because of climate change are intense drought, storms, heat waves, rising sea levels, melting glaciers and warming oceans.

These are global effects of climate change but some ways we are being affected just here in Portsmouth are warmer winters. These may bring more rain and less snow to New Hampshire. A decrease in snowfall would shorten the winter season which could harm recreational industries like winter sports/activities, and the local economies that depend on them. The effects of climate change in Portsmouth can also include the reduction in availability of local natural resources, rising sea levels on our many shores/bodies of water, and warmer summers. New Hampshire isn't an area that gets a lot of harsh natural disasters other than snow storms, but we could receive more as climate change continues. So that's where Lily Patterson´s and Luci DiMecoś idea comes in to make an effort into reducing the burning of fossil fuels in Portsmouth, New Hampshire!

Our idea was to install a renewable energy source on top of hotels across Portsmouth. Thinking about how much energy is burned from hotels is astonishing. Hotels use energy to power all the rooms tvs and water systems not to mention the heating and cooling. We burn so many fossil fuels each day for our everyday uses. Energy is all around us which creates carbon dioxide. This kills our planet its warming up everyday according to NOAA's 2020 Annual Climate Report the combined land and ocean temperature has increased at an average rate of 0.13 degrees Fahrenheit (0.08 degrees Celsius) per decade since 1880; however, the average rate of increase since 1981 (0.18°C / 0.32°F) has been more than twice that rate. This data is showing how since that time our temperature is rising increasinging overtime and is becoming more rapid. If this is not stopped our planet will turn into an underground pool. Habitats will be ruined and animals will die. Housing near coasts will soon become underwater since sea level rise. Our world is in real danger This is why
Putting solar panels on top of the roofs would turn that bad energy that kills our planet and turn it into a renewable source that will even create energy that is sustainable for our city and places around it. Having these solar panels on hotels will over time lower our carbon footprint. We chose these hotels in particular because of the roof's size but also their structure. In particular the sheraton hotel's roof shape has lots of sides and is very large. The roofing is kind of like a trapezoid with 3 sides so it could fit many solar panels reaching different angles of the sun. This is important because if it's sunny on one part of the building solar panels would still hit it. We would save lots of energy by installing solar panels.

Similar Solutions from Around the World: Courtyard Marriott - Lanchestion this Pennsylvania hotel installed 2700 solar panels on the roof. That's 2 football fields. They are now 100% solar. This canceled all of their electric bills.
Another southern california hotel saved $8000 per month after they installed their solar panels. Their hotels are smaller but still produce over 13,000 kWh per month, which lowers their energy bi;; by 35-45%. Seeing how places around have started installing solar on hotel rooftops actually shows its beneficial and saves not only energy but money too. Although they are expensive in the long run it seems that they have saved lots more money. This goes to show that this method on hotels has brought hotels energy and saved it. But this plan design did not only use in America a hotel in Chile the Tierra Atacama hotel installed solar panels 588 of them on their 10,000 sq ft hotel and it covered all their energy needs.

plan.https://earth.google.com/earth/d/1pL1yoNBtZ-3fTWBiEoOhg3hG_BtwGqFD?usp=sharin

Project Constraints and Challenges: Some possible challenges include the fact that these materials can be very expensive. The average amount per solar panel watt in nh is about 2.35. So depending on how many watts are in the solar panels that go on top of the hotels, the pricery they are. Also the process of building the solar panels could use a good amount of money. First, hiring people to build them, but also the materials used to build them. Another step of making our plan a reality is making sure solar panels are right for certain fossil fuel relying things in the hotel. An article by National Geographic from 2019 says that although solar panels make a bigger impact then a negative one there are some negative impacts on the environment like land and water use pollution, habitat loss, and use of hazardous materials in the manufacturing process. Overall these challenges we think solar panels are a right fit for Portsmouth because we get a lot of sun in all seasons especially in downtown, and Portsmouth already has many people making efforts into turning away from fossil fuels!

Importance of Proposed Solution:
Even though there would be some setbacks and would take time we would look at the bigger picture which is the results of the solar energy. Our plan is important because if we install them on top of hotels it will make a big difference on the areas around it but also on the hotels itself. It would take time to install but with time it will also make renewable energy that can be used in a healthy way. This would lower our temps by not using carbon for our electricity. We think the city of Portsmouth should consider and install solar panels on our Portsmouth hotels. It will give our city the step it needs to become a healthier community. When the solar panels attract the sunlight it turns into energy that can be used throughout the hotels that is sustainable and won't emit carbon. This would give us the satisfaction of using energy in the hotels and knowing that it's not ruining our environment and we are actually doing good for the city by using them. Through the process of long installation and expense we would also have more beneficial areas in our city that will attract more tourists.

Project Conclusion:
In conclusion, if our city doesn't start somewhere, nowhere else will. We can lead and start our change. Thinking of where we would be by 2030 without doing something is unbelievably scary. We won't have much of a world if our temp keeps rising. Continents will start to shift , coastal lines will soon overflow and be under water, people will have to evacuate and start to move leading to people losing jobs. Do we really want to continue to sit and not fix anything? We can start doing something and make change by adding our renewable energy source,solar panels on top of our local hotels. The real problem is that people don't think we need to do

anything. But that is when they are wrong although you might not see anything wrong statistically our temperature is rapidly increasing and carbon in our atmosphere is going up. Although people might not see the problem, it's there and sooner or later everyone will experience what some places are already experiencing. This isn't a big change but we can bring attention to other cities or places and inspire them to change along with us. This would give our city a positive outake on reducing our carbon emission from hotels. People have started to change places around the world and they have been seeing a positive outcome to what they did so we shall do the same. It would be a sustainable change that our city needs.

Renewable Energy Proposal - 2030
City of Portsmouth
Prepared by Emilia Greco and Amalia Kimball
April 1, 2022

Project Narrative:

For hundreds of years, humans have been producing carbon dioxide: from building complex factories to simply breathing. As this carbon dioxide gets released, it stays in the atmosphere as a greenhouse gas. Greenhouse gasses have the same effect on the earth as a greenhouse does for plants. They trap the heat and confine it to the earth, therefore, warming the earth's temperature. Even a small rise in the Earth's temperature will/could be disastrous for most ecosystems, including humans. Greenhouse gasses are mainly produced from burning fossil fuels like coal, oil, and natural gas. These energy sources are used in common household appliances like heating, lighting, air conditioning, ovens, showers, etc. Carbon dioxide also comes from cows, specifically cows in slaughterhouses (another human-caused source). As more people are born and our human population grows, we need more factories and housing that produces more and more carbon dioxide. In 1960, carbon dioxide was around 300 parts per million, currently, the level is at 430 parts per million.

Starting from 1960, the Earth's temperature spiked at an alarming rate along with the carbon dioxide levels. The rise in temperature from 1960 until now is 0.14° F. That may seem like a small increase, but it takes very little to upset the delicate balance of life on Earth. We know it commonly as Climate Change, long-term changes in the climate that occur over decades, centuries, or longer. It's even estimated that by 2100, the temperature will have risen 2-4 degrees celsius. Having this major temperature rise has affected many different lives and ecosystems. The warming temperatures affect the sea levels, changes in rainfall, melting snow and ice, more extreme fires, and drought.

Portsmouth, New Hampshire would especially suffer and is suffering from rising sea levels. The homes and small businesses on the coast could be destroyed if we don't do something about climate change soon. The extreme effects will be enough to put historic and modern buildings underwater. It could also affect our weather with more rainfall and more extreme storms. Annual precipitation has already increased by 7 to 20% throughout the whole state. Temperatures in New Hampshire (including Portsmouth) have also increased. Previous averages were that we only had about one day a year that went over 95 degrees but we now have people reporting several. The nor' eastern storms that happen in New England already cause harm, but climate change is likely to make them even worse.

Portsmouth (and New Hampshire) has few renewable sources of energy so we can't move away from producing carbon dioxide and greenhouse gasses. Nuclear power, being one of our biggest and only sources of renewable energy, is produced at Seabrook Station. If the plant is not renewed, we have no other renewable source of energy other than minimal solar power. Climate change will also soon be detrimental to our economy. Air conditioning and heating will become more expensive and near impossible to keep up with. With the increased rainfall, people won't be able to pay to keep pumps running and flooding would only be natural. If Portsmouth is underwater, tourists won't want

to come to visit anymore, therefore, losing thousands of dollars. In New Hampshire in 2019, 5.6 billion dollars was spent on tourism.

In addition to destroying homes and businesses, rising seawater can carry a lot of diseases and introduce them to New Hampshire. Portsmouth, being right on the coast, has a lot of fishermen and fish is a popular food here. Rising ocean temperatures could start to be dangerous and unfit for fishing making those people lose their jobs and Portsmouth losing a signature food.

There could also be invasive species arising that thrive in warmer temperatures that make it hard to progress as a society. All in all, if Portsmouth, New Hampshire doesn't do something to contribute to the fight against climate change, will be damaging to the community and economy making it harder to live comfortably.

Proposed Renewable Energy Solution:

Our idea for renewable energy generation in Portsmouth, NH is to put solar panels along the rooftops of some of the big and new apartment buildings in our city. We would start by installing raised solar panels on top of the West End Yard and Brewery 195 apartments buildings. These buildings are in good areas that get the best amount of light due to their height and location. It would also be a prime location for solar panels because of teh flat roofs. We propose that whoever installs solar panels gets a 20% tax incentive on residential homes. This adds to the 22% federal tax credit. This energy is a better cleaner source of energy because it can be stored with solar batteries and sold to electricity companies for profit. Solar energy from panels can be stored for up to 18 years without being used, and even after being used, they can be reused. The apartment buildings we have chosen have been built within the past 3 years, meaning they have very new technology and resources to be able to input these high-tech and innovative solar panels.

Using solar panels would help the city of Portsmouth by providing a clean source of electricity for the cold winters and the hot summers. Around 44% of people in New Hampshire use fuel oil as a primary source of heat. For the short days in winter, the lights are on a lot. Having solar electricity would allow people to keep their lights on without having to worry about overbearing prices and hurting the environment. Solar panels have to be replaced every 25-30 years. Some of the most expensive come to around 3,000 dollars. Though that is a lot of money, if you compare it to other repairs to the technology we have currently and the other renewable energy options, it isn't too bad. Solar panels and solar energy have been tested more than other renewable energy sources and have a

Similar Solutions from Around the World:

Germany is one of the world's leading countries for solar power energy. In 2011, solar power provided approximately 3% of total electricity. In 2011, the German government set a target of 66gw of installed solar power capacity by 2030. Germany aims to have 80% of electricity from renewable sources by 2050. Germany has long-term energy contracts that provide payments to energy producers based on the cost of the generation. Germany instituted the Renewable Energy Source Act and is now partially funded by the federal budget. Germany has helped lower the price of solar power by installing so many solar panels in their country. German farmers are some of the civilians who have benefited from solar power, gaining 25% of their income from generating and selling renewable solar power. Germany is now one of the most innovative and healthier energy-sourced countries in the world. Germany and New Hampshire are close to the same latitude line, making them get about the

same amount of sunlight every day. Sunlight is a key ingredient of solar-powered energy and if Germany and New Hampshire get about the same amount of it, we should be able to generate some of the same energy. New Hampshire is significantly smaller than Germany but if we try and persist, we can generate enough for at least Portsmouth, New Hampshire.

Germany has put so much effort and persistence into making their country one of the biggest Solar-powered countries in the world. They have made so many improvements to slow down the spread of climate change. If other countries, including the US, start to use more solar power energy, we can become such a healthier and happier economy.

Google Map: Enclosed is a link to a Google Earth map that includes specific information and locations for the renewable energy plan.
https://earth.google.com/earth/d/1USmUrqdclGwq_h3ITlm1lozpBDC--CWM?usp=sharing

Project Constraints and Challenges:

Solar energy isn't the perfect or only solution to climate change out there. Every solution has its own set of drawbacks including solar power. Some challenges that could arise would be cost, getting permits, and some more. The initial cost of solar power is fairly high. Though it does usually pay itself back by either selling it to the power companies or getting enough people to install it. In this case, it would hopefully be paid by the tax incentive in place. Because we proposed to install solar panels on the roofs of privately owned buildings, they would need to agree. If they don't, then it could be a major risk. Finally, the sunlight that comes down impacts how much energy we actually make. Portsmouth doesn't get the sunniest days in the winter but we do get very sunny summers. If construction were to start in the winter, you could start generating electricity almost immediately.

Solar energy can also affect the environment in negative ways. One common concern is land and habitat loss. Our solution is top of buildings so we wouldn't need to worry too much unless in the future, New Hampshire, or just Portsmouth, built a solar farm. Depending on the company and how they manufacture solar panels, some can be made with hazardous materials like photovoltaic cells. These are needed to convert sunlight into electricity. When these panels go to landfills, they make valuable materials go to waste. The toxic materials can also leak out and contaminate landfills further.

Importance of Proposed Solution:

Even with some restraints that solar power carries, we believe it would be the best option to use solar power throughout Portsmouth. Solar power is cost effective and allows for other purposes like earning profit and other benefits.

Project Conclusion:

Why is Solar power good for Portsmouth New Hampshire? First of all, Portsmouth gets a lot of tourists, especially in the Fall when all of the leaves on the trees turn colors. Tourism brings a lot of income to Portsmouth, giving us money to invest in solar energy. If we go solar, we will still be able to have certain jobs, like a fisherman. Fishermen are in danger of losing their jobs due to the rising ocean. Solar power pays itself back in years, because of how much money it saves and teh profit earned over the years from selling it back to power companies. In case nuclear power doesn't work out in the long run, we have a backup. If New Hampshire starts solar power, we are setting an example for other states, which is encouraging them to also go solar or use other renewable energy options, saving both the environment and money for the US. Solar is cheaper than

other options, it mostly only costs money to install it and from then on we are gaining rather than losing. Proven by Germany, we will still be able to have the New England winters that everyone loves and people will still be able to ski. Flooding is also a major issue for Portsmouth now and will become a bigger one in the future. If we could minimize the amount of carbon being released into the atmosphere, it would slow the eventual rise of seawaters and also minimize flooding. It would also help with the newly more extreme storms that contribute to flooding. Having solar power installed in your home or on city/private-owned buildings increases its value as well. Having solar energy also creates jobs for people in need like manufacturing, development, and such. Overall, solar power would be one of the best options for Portsmouth, New Hampshire in the pursuit of slowing climate change.

Renewable Energy Proposal - 2030
City of Portsmouth
Prepared by Elise Katzenstein
April 1, 2022

Project Narrative: (should be approximately 2 - 3 paragraphs in length introducing the science behind human-induced climate change and the possible impacts in Portsmouth, NH for the future)

Earth is known as a Goldilocks Planet. It's not too hot or too cold. It's "juuuuuuust right" and perfect for supporting life! And our atmosphere, which is where a process called the greenhouse effect takes place, is what makes it habitable. In the daytime, the sun shines through Earth's atmosphere and warms its surface. During the night, Earth's surface cools which releases heat back into the air where some of it is trapped by the gases in the atmosphere. These heat-trapping gases, carbon dioxide, methane, water vapor, and others that are less abundant, are called greenhouse gases and are responsible for the greenhouse effect. Earth needs a **balance** of these gases to maintain the perfect temperature for living things, but, some human activities are changing Earth's natural greenhouse effect and upsetting the balance. For example, burning fossil fuels like coal and oil releases carbon dioxide into the atmosphere. In 1960, atmospheric CO2 levels were at 316.91 ppm (parts per million). This has risen dramatically and in 2020 it was at 414.24 ppm (the scientific benchmark for a normal climate is only 350 ppm.) These excess greenhouse gases trap more and more heat which is warming our planet. This is evident in the temperature anomaly data. In 1960 the temperature anomaly was 0.0 degrees celsius. In 2020, it was at 1.01 degrees celsius. Therefore, the more fossil fuels we burn, the more carbon dioxide is released into the atmosphere, and the higher the temperature rises. This is a basic explanation of climate change.

Currently, in the US, most of our electricity is generated using fossil fuels. The biggest 3 are coal, crude oil, and natural gas. If we continue to use these fuels as energy sources, there will be serious repercussions and the climate will be permanently altered. This could mean a loss of species, a lack of food, an increase in natural disasters and more extreme temperatures, worsened air and water quality, health risks, and so many more. It will even affect us directly in Portsmouth! The increase in temperature will cause glaciers to melt and sea levels to rise. This will affect people living on or near the coast, like people in Portsmouth. The estimated sea-level rise by 2050 is around 6 inches! When the sea level rises it will flood towns like Portsmouth and could force us to leave our homes and businesses. Not only will this affect us (and our wallets), it will also harm animals living in the ecosystems in the flooded areas. Climate change is not a minor issue that we can worry about in the future, it is an immediate concern for ecosystems, human livelihood, and the city of Portsmouth!

Proposed Renewable Energy Solution: (identify **ONE** specific idea for renewable energy generation in/near Portsmouth, NH. Include your claim about what your solution could do for Portsmouth to reduce the use of fossil fuels).

My proposal for the City of Portsmouth is to enter into a Power Purchasing Agreement (PPA) with a private solar power company and install solar panels on municipal buildings to generate electricity to power them. A PPA is a financial agreement where the solar developer arranges for the design, permitting, installation, and financing of a solar energy system at little to no cost. The developer (and owner of the panels), sells the electricity to the host customer at a fixed price that is normally lower than the local utility retail rate. The lower electricity price offsets the customer's purchase of electricity from the grid. The developer profits from the income of the electricity sales and tax credits or other government incentives from the system. The PPA will typically last for 10-25 years and the developer will remain responsible for the

operation and maintenance during the duration of the agreement. When the PPA contract ends, the customer can choose to extend the PPA, remove the solar system, or buy the system from the developer.

I would place the solar systems on multiple municipalities in Portsmouth. The locations would be Porstmouth Town Hall/Police Station, Portsmouth Fire Station, Portsmouth Public Library, Portsmouth Middle School, Portsmouth High School, New Franklin School, Little Harbour School, Dondero School, Foundry Parking Garage, and Hanover Parking Garage. The solar panels on top of these buildings would supply energy to these locations. This idea would eliminate direct CO2 emissions from producing energy for government buildings. This system would also be cost-effective. The average residential electricity rate in New Hampshire is 20.24 cents per kilowatt-hour (kWh). The average price (in 2019) for a utility-scale PPA is only 2.74 cents per kWh. If the PPA price was the same as the average price in 2019, the town would save almost 10 times on electricity if they switched to a PPA contract! Portsmouth should go green to save green!

Similar Solutions from Around the World: (reference evidence from other countries/states/cities around the world that have used a similar solution to what you are proposing. Include the impact of those efforts)

This plan is not a new idea. Many towns and cities across the world have instituted the same or a very similar plan. Montgomery County, Maryland, a Washington, D.C. suburb, has installed solar panels atop libraries, recreation centers, and a fire station. Peterborough, New Hampshire has also taken initiative to reduce its carbon footprint. The town's water treatment plant is solar-powered which saves the town 20,000 dollars in energy costs per year. Both Mongomery County and Peterborough have a power purchase agreement with a private company that paid for all the solar energy costs upfront including buying and installing solar modules. They buy from the power company at a rate that saves them money because it is less expensive than buying power from their local utility company.

Portsmouth has already done something very similar! 2 large solar panel arrays have been installed at Portsmouth High School and Portsmouth's Madbury Water Treatment Plant. The panels currently supply 11% of Portsmouth High School's energy and 25% of the Water Treatment Plant's energy. The solar panels were built as a part of a PPA with SunRaise Investments. Portsmouth will purchase below rate electricity from the solar arrays for the next 25 years. The 2 arrays are equivalent to a reduction in 525,000 pounds of coal burned or 55,000 gallons of gasoline consumed in a year. If possible, we would place enough solar panels on Portsmouth High School's roof to supply 100% of their electricity. Even such a small percentage of the municipalitys' energy coming from renewable sources has a huge impact on the planet. Imagine the result if we placed solar arrays on all municipal buildings.

Google Map: Enclosed is a link to a Google Earth map that includes specific information and locations for the renewable energy plan.
https://earth.google.com/earth/d/18mppFQR1pswP6BhtqiIBfVKhgdK_MP15?usp=sharing

Project Constraints and Challenges: (list some of the challenges that you can envision might exist for implementing your plan. Describe the possible negative impacts on the environment that could occur because of your solution)

A challenge that this project could face is that the cost per kWh could increase as the contract goes on. This would make purchasing the energy more expensive than when the PPA first began. But, this would not be an unpredictable increase. The solar company would include the percent increase in the contract and even if the price were raised, it would most likely still be cheaper than purchasing from the utility company. Another issue is that some of the roofs where I have requested solar panels may not be strong enough structurally to support the array. The solar panels might be too heavy for the roof to support so this might not be a viable option. The last problem is that solar panels are, of course, reliant on the sun and if the location does not receive enough direct sunlight, the company won't install the panels.

Importance of Proposed Solution: (make a compelling argument about why the City of Portsmouth should adopt your renewable energy plan. Even with the challenges listed above, explain why your plan is important and can address human-induced climate change caused by burning fossil fuels)

Even though the project may face a few challenges, it is of utmost importance that the city of Portsmouth takes steps to help stop global climate change. The issue has been ignored for far too long and we must take immediate action to reduce our carbon footprint. If we don't lower our carbon emissions by 45% by 2030, the 1.01 degrees celsius anomaly will rise to over 1.5 degrees, and with this rise in temperature will come a collapse of the world's ecosystems. We have less than 10 years to slow this trend and avoid the worst consequences of climate change.

Project Conclusion: (provide the reasoning for why your solution would be positive for Portsmouth, the global climate and a switch from fossil fuels for energy needs. Make a final argument why your solution for renewal energy is important to implement before the year 2030)

This plan would not only reduce fossil fuel emissions but also save the town money on electricity bills. It might seem silly to make such a change in a town as small as Portsmouth, but every contribution adds up. We must must must act now before we alter the world beyond repair and suffer the consequences.

Renewable Energy Proposal - 2030
City of Portsmouth
Prepared by Turner Leduc and Samantha Hueber
April 1, 2022

Project Narrative:

During the early 1980s, a large increase in worldwide temperatures had caused and those temperatures have only been increasing more and more. This is because of the emissions of carbon dioxide that we have been constantly releasing into the atmosphere from burning fossil fuels and vehicles such as large trucks and cars, or to the extent of our electricity source. These emissions have an incredible impact on our environment due to the greenhouse effect, which traps heat from escaping into space and this process was originally intended to keep the Earth warm. However, carbon is being trapped in the atmosphere along with this heat, only warming up our planet more and more. If we are not able to reduce or simply limit the number of carbon emissions that are currently going into the atmosphere, the world will collapse in every way, shape and form. Carbon Emissions are currently the main contributor to Global Warming, Health Concerns, Sea Levels Rising, lack of food for humans, and wildlife extinction of many sea creatures and fish. With this we will also gather more of a population, only increasing the rates. A projected statistic from 2100 projections says; "Assuming the contributions are made in full, atmospheric CO2 is projected to reach about 670 parts per million (ppm) and the global average temperature increase is projected to reach about 3.5° Celsius above pre-industrial levels.

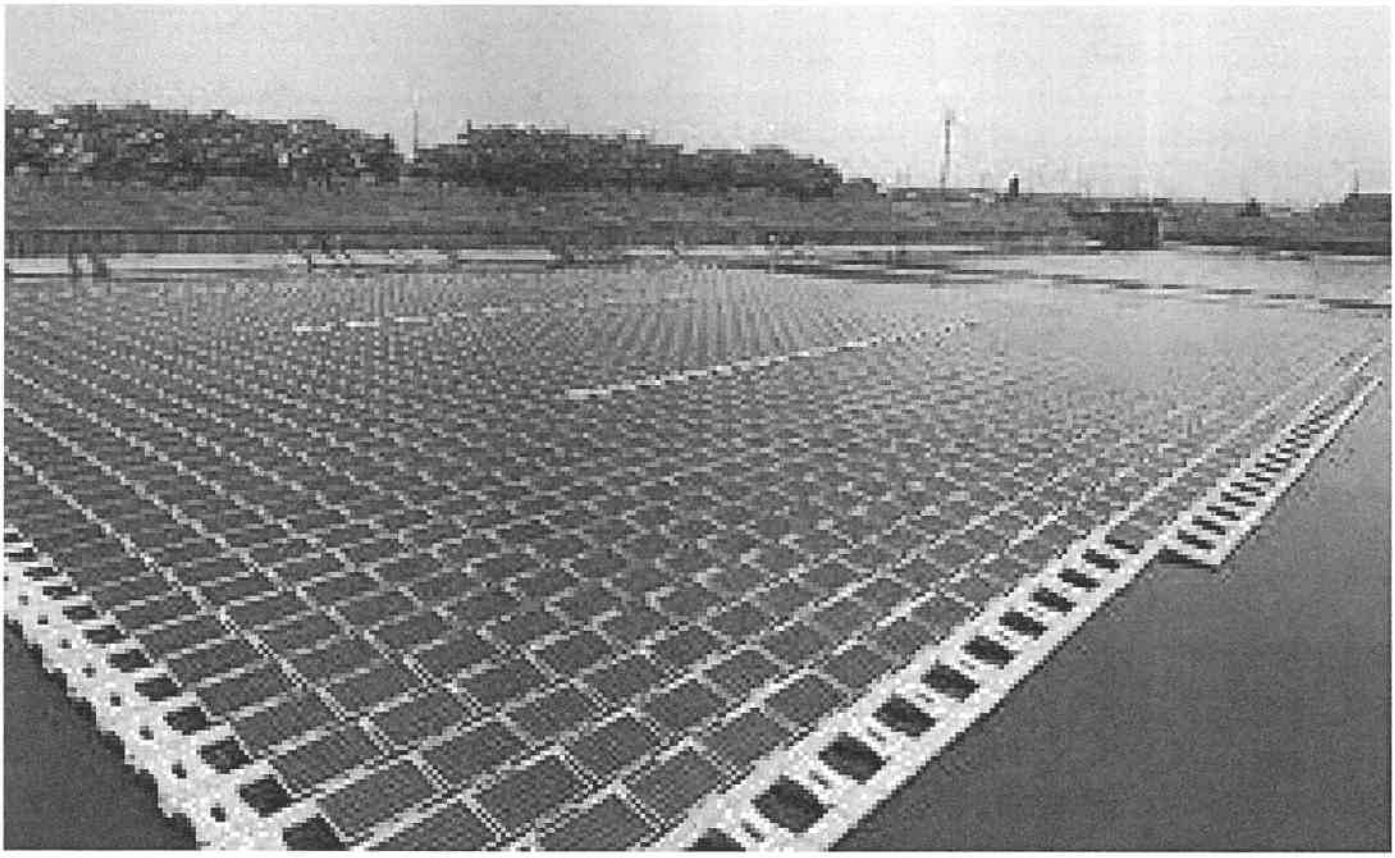
Climate Interactive did not post underlying data for its analysis when the above graphic was updated on December 11. However, prior analyses show a continual rise in global greenhouse gas emissions throughout the 21st Century until 2100 when projections stop. That is, the projections do not indicate stabilization of global emissions, atmospheric greenhouse gasses, or global temperature." (2.0 degrees is also called the turning point, and when chaos is about to strike, so we will surpass that) If you click here you can see the major impact that only rising sea levels can cause in our town. This is all the more reason to start considering alternative routes to avoid this issue.

These problems have already begun affecting our cities and homes after so many years of polluting the air. With the increase in human population, the carbon emissions also go up with it, and now our planet is one degree warmer than it was 140 years ago. That may not seem like a big deal at first, but that increase lasted in the span of only the last forty years. That's not the worst part either, many estimates have shown that the total amount of forests, including man-made ones, are rapidly dying out, which reduces the amount of oxygen being released into the air and makes more space for carbon to take over. And, if our sea levels continue to rise when the waters rise above five feet, they'll even begin to hit our middle school and other important locations in central downtown. After all of these issues, we must come up with some kind of way that can help us solve this matter and put an end to these high risks in our town. Fortunately for us, we have a detailed plan that could benefit the entire town, and all it takes are the Mill Ponds.

Proposed Renewable Energy Solution:

The solution we have in mind for the Climate Change crisis is a solar idea, but with a twist. Instead of putting the panels on traditional rooftops, we had the idea of putting the panels on the water. This way it wouldn't take up any additional space, and make the water a multi-purpose pond. The place we have in mind for this proposal is the Mill Ponds, and by putting the panels here, we wouldn't affect any port traffic. In other

words, no profits from the ports would be delayed, and Portsmouth could continue with its normal life. The other reason for these Ponds to be the prime location is that they are still water, with no true form of waves popping up. Since the panels we have in mind are Floatovoltaics, they will be rafts, and the waves could seriously impact their effectiveness.



Speaking of the Panels, these panels are like ordinary panels, producing up to 400 watts of power an hour. But, since they are on the water, it cools the panels, making them have less chance of malfunctioning, and keeping productivity at higher rates. In fact, we have done the math for these two bodies of water, and if there was a sunny day every day, we could sustain 7210 homes with some to spare. This is a massive amount of energy and money saved, totaling up to a whopping $9,949,800 for energy (since the average person spends 115 dollars per month on electricity). This is a small space we are talking about that is currently going unused, and we can save almost 10 million dollars just by installing them!

Finally, we need to realize Panels will only benefit the community. We will not distill any land by doing this, and it will only save us in the future. The fossil fuel industry is having harder and harder times finding the resources needed for the fuel. The source MAHB states "Oil will end by 2052 – 30 years time. Gas will end in 2060 – 40 years' time. Coal will last till 2090 – 70 years time. However, according to BP [5], the earth has 53 years of oil reserves left at the current rate of consumption." As seen here, we are at a limited time to convert to the renewable energy side, as resources are running low, and the cost will go up. We would not only be a leader in the future but also save in the process.

Similar Solutions from Around the World:

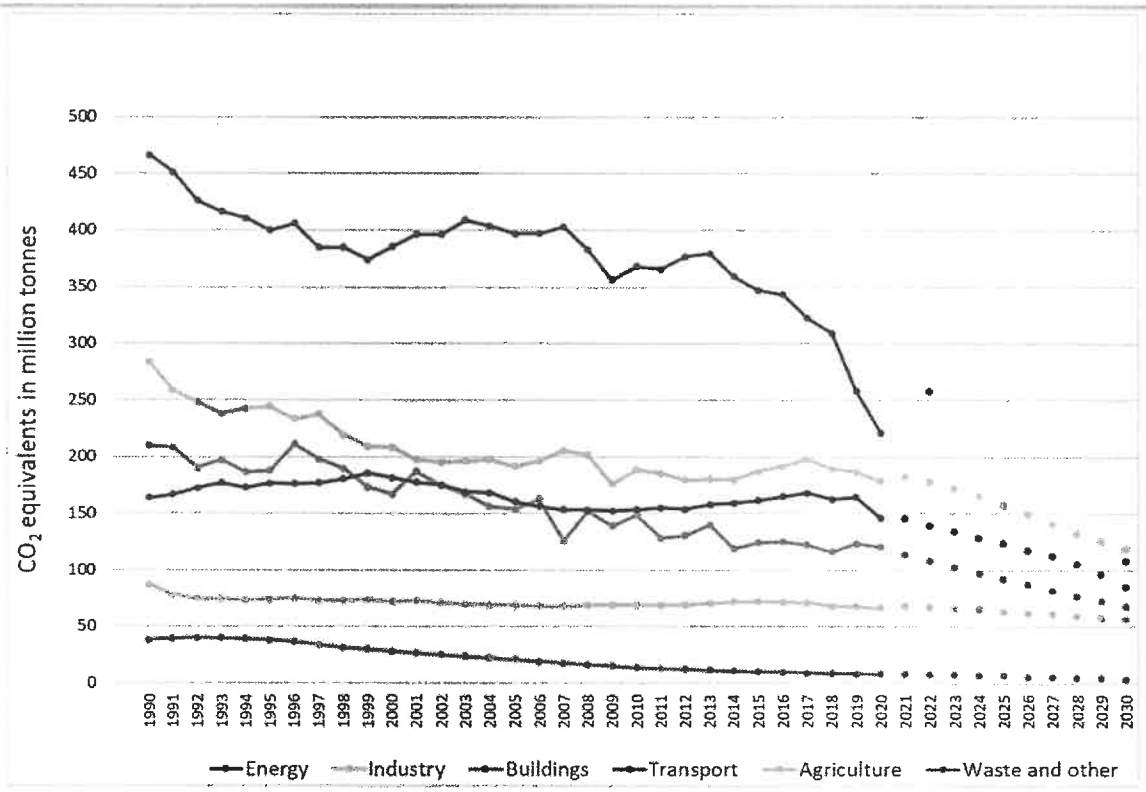
One of the current largest solar energy users and consumers in the amazing country of Germany. This powerhouse is leading the industry in terms of the amount of solar energy, and by amount of panels. Instead of putting their panels on the water though like we intend on doing, their goal is to use massive plains of abandoned farmland as the places for the panels, and when at peak production time (noon), the panels can generate 40% of the country's power demand. The reason for the panels being so effective is the amount of land

they have, along with the flatness. To put this into the comparison of the USA and if we utilized these strategies, Renewable Energy World stated: "In 2000, U.S. farms numbered around 2.18 Million. Assuming that one farm building (with at least 800 square feet ready for solar) exists per farm, and one 8-kW system is installed on each building, solar energy produced on U.S. farms would amount to 23.98 billion kWh per year. To put this in context, this is enough solar electricity to power *all of the homes* in Wyoming, Alaska, North Dakota, South Dakota, and Montana combined." As seen here, if we were to put panels on the farmland that is considered unnecessary, then we can seriously improve our rates with carbon emissions, and leave a better carbon footprint. Germany had been able to reduce its carbon emissions print in extreme amounts:

German greenhouse gas emissions by sector 1990-2019 and emission budgets 2020-2030

Data: UBA (2021) / Climate Action Law (2021).

CLEAN ENERGY WIRE



Note: Without emissions from land use, land use change and forestry (LULUCF), 2020 data preliminary

(From CEW Clean Energy Wire) This graph here displays the dramatic decline in Carbon Emissions from Germany, and the huge effects it has had on them. They now have much fewer costs for the electricity bills, which now average to be 415 euros or 460 dollars. They now aim to become greenhouse gas neutral by 2045. It has set the preliminary targets of cutting emissions by at least 65 percent by 2030 compared to 1990 levels, and 88 percent by 2040.

Japan is one of the biggest manufacturers in the world that produces solar panels and is also known for its many distributions across the globe. The solar panels get exported to large countries in need of solar energy, such as China. Because China is such a large country it can produce mass amounts of energy, even if not much area is used to produce solar energy, and now, China is expecting to add from 75 to 90 Gigawatts (GW) of solar panels across their territory by the end of 2022. Even India was able to create a change by achieving its goals of 20 Gigawatts four years ahead of its original plan. "The Indian government had an initial target of 20 GW solar capacity for 2022, which was achieved four years ahead of schedule. The installed solar capacity in September

2020 was 36 GW and India has an ambitious target to achieve 450 GW of renewable energy capacity by 2030. Solar and wind energy have the lowest cost of power for new capacity." These countries were determined enough to create a change for our future, so much so that some of them were able to find new ways to create renewable energy or convert to this energy faster than the initial plan.

If America is able to be just as committed to fixing these worldwide issues, we could create an unparalleled and environmentally-friendly community and we won't have to worry about these issues any further. These ideas may be expensive at first but cutting the costs down is possible, as well as creating fair opportunities for those who are willing to step up and help produce renewable energy for their homes. Finally, as seen in the previous segments, you will get the gist that we need to follow these countries' examples they are setting for us. They are the ones who know how to do this the correct way, and all we have to do is tag along.

Google Map: Enclosed is a link to a Google Earth map that includes specific information and locations for the renewable energy plan.
https://earth.google.com/web/data=MkEKPwo9CiExdnIoWjBpQkRyRUxIWC14MWY4WmxPTmpwLVVVSDlxYlkSFgoUMEU5NDgxOTNDMDIwRTdDNUI4MDcgAQ

Project Constraints and Challenges:

With this new installation of solar panels, two possible issues might occur. The first one is the wildlife impact that these will have, and the loss of habitat. While the Mill Ponds might not be home to lots of aquatic animals, the geese, ducks, and herons will have issues with trying to get around the panels, and the viewing for people will not be as pleasant. For example, since the panels do take up the majority of the ponds, there will be limited space for these animals to feed or roam. This may upset the people of Portsmouth or the Animal Health agencies or will cause the animals to move grounds. The other issue with the animals is they may damage the panels by their curiosity. This is very common among animals with new objects in their environment, and would likely be a consistent problem. The animals could stand on top of the panels, which could affect productivity, or break the system with their beaks and such.

The other issue with putting the panels here is the tide may have an impact on the panels. Since the ponds are affected by this, when there is a low tide, the panels by the edge may begin to get stuck on the shore and damage the bottom. But, the exact opposite could happen with a king tide when the panels begin to shift over the actual pond. Both of these instances have a chance of breaking the panels or moving them into not as productive areas. Another issue with the tides is that when a tide goes out or in, it may drag the panels with them, creating another possibility of harm. Tides though are predictable, so we should know when to secure the panels more, or where to install certain ruts on the bottom to keep them flat for low tide.

The final main issue with this idea is the snowy weather, and the harsh amounts of ice we receive in the winter months. The ice can seriously damage the integral parts due to it being in the water, and if there is snow on top, the panels would not operate. Any type of Northeastern winter weather would likely be the cause of a shutdown for the system. One good thing though about having them on the Mill Ponds is that there will be no frozen water, so this will help greatly with the amount of maintenance required.

Overall though, these two likely problems can easily be fixed with the installation of additional mechanics, or crews to help clean or take care of animals. This should cost much additional money, and would in the end be beneficial to secure a good and stable source of energy for Portsmouth. If these do become more serious problems though, we can make special arrangements with the manufacturers to help ensure the panels are protected.

Importance of Proposed Solution:

Even with the issues we have discussed thus far about our proposal involving solar panels, we still firmly believe that these "floatovoltaic" panels should be installed within Portsmouth's community. Our plan is important to our future and can influence neighboring communities and towns to convert to renewable energy as well. According to Wilderness.org; "The good news is that the United States is a big country and there's plenty of space for solar farms. But we have to be careful where they are placed in order to preserve wildlands and wildlife. The best places are the ones already developed and near transmission lines and roads.

A great example is the Dry Lake solar zone. The solar farm near Las Vegas, Nevada, powers 46,000 homes but has a relatively low environmental impact." They, along with many large corporations and people around the world, believe that we should convert to different types of renewable energy as soon as possible and before it's too late. We can kill hundreds of plant and animal species just by harvesting energy, imagine what we do when we use that energy to power small things like outlets and light bulbs. We need to show the nearby towns that, even though there are drawbacks to our ideas, we can still do incredible things and produce a better environment for our future generations.

Project Conclusion:

From the evidence, we have displayed, and the ideas we have brought to the table, you will have come to realize that there is nothing to lose in this investment, and it is only to our benefit. It is a win-win situation. Since the land will not be tampered with, and not affect any shipping routes. Also, we have evidence that as of 2020-2021, it is in fact cheaper to use renewable energy instead of a fossil fuel type resource. This will not only prepare us for the future events of Portsmouth but also protect us from the whiplash of Mother Nature. Statistics show that there is definitely a day (that will come soon) when we are officially out of fuel, and without electricity, a city can't function. We are quickly approaching the 2.0-degree celsius mark, which as stated before, is the deadline for the world to re-order itself. If we do decide to put in the panels, then we will be one step closer to being ready for the CO_2 powerhouse. Overall, this idea will help us no matter how you think of it, and the pros will always outweigh the cons.

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Renewable Energy Proposal - 2030
City of Portsmouth
Prepared by: Khloe Randall
April 1, 2022

Project Narrative:

Climate change is a major concern for the world and America. This is such a major concern because it is affecting almost every aspect of life, from sea life to human life on land. There are many consequences that come from climate change that are constantly getting worse and worse every day. One of the consequences of climate change is the more frequent and intense natural disasters. Locations all over the world have suffered immensely from very intense and frequent natural disasters like tornados, hurricanes, droughts, heatwaves, and more. This is a threat to human civilization because homes and other buildings are being destroyed during events like hurricanes and tornados, and we are running out of water resources around the globe because of the heat waves and droughts. These extreme weather conditions are affecting humans' crops and livestock. We can't grow food when we are in a heatwave or a hurricane. This is causing us to have to charge more for food which is very hard on some families who aren't financially stable all the time. Along with storms and natural disasters, climate change is also melting our ice and causing our sea levels to rise. We may not pay attention to this and may not think that this is a major concern, but it is. Animals like polar bears are currently dealing with losing their homes and habitats due to the ice melting in the poles, and humans may soon start to face the same consequences as the polar bears. We could end up losing our homes and we will have to evacuate. Our sea levels could rise so high that they end up destroying our homes and other buildings. When the Earth warms, it causes glaciers, icebergs, and ice sheets to melt. This adds more water to the ocean which causes it to rise. There are graphs that show us that the amount of Arctic sea ice at the North Pole is going in a downward decline since the year 1980. In the past 100 years, our sea levels have risen about 6-8 inches. We may not think that 6-8 inches is a lot and won't affect us, but it will. Climate change is worse than it ever was before. This means that sea levels will rise more than ever before. There is a sea-level rise viewer website, https://coast.noaa.gov/slr/ that predicts and shows us what will happen to our land if the sea levels continue to rise at the rate that they are. We can see that at just 1 level of sea-level rise, we are already slightly affecting the coastlines. In Portsmouth, NH we can see that at 1 foot of sea-level rise, we are already seeing the water rise up onto places near Sagamore Creek. This water will end up moving toward buildings, homes, etc. causing water damage. If we keep going in the direction we are going, the sea levels could rise up to 10ft. With that much sea level rise, buildings in Portsmouth like the Public Library and Portsmouth Middle School, would all be gone and destroyed. 10ft might sound like a lot, but it isn't. At the rate we are going with climate change, it won't take long. In all of America, climate change could also greatly affect human health and the air we breathe. Climate change is constantly polluting our air and worsening its quality. Air pollution can lead to asthma, heart disease, lung disease, and more.

The definition of climate change is "long-term shifts in temperatures and weather patterns." It also says, "These shifts may be natural, but since the 1800s, human activities have been the main driver of climate change." This is true. Climate change before was natural, but we have now made climate change human-induced, but some people don't believe it. Climate change comes from us burning fossil fuels like coal, oil, and gas. These fossil fuels are being burned constantly to generate almost all of our energy for the United States. We use this energy to generate electricity, power transportation, power our businesses, etc. Although these materials are easy for us to use and they work well for us, they produce very large amounts of heat-trapping gases called greenhouse gases. These greenhouse gases end up sitting in the atmosphere around the earth and trap the sun's heat. This causes global warming/climate change to happen. The greenhouse gas

that is doing the most damage to the earth is carbon dioxide. Carbon dioxide is the largest greenhouse gas being released from burning coal, oil, and natural gases. Carbon dioxide is the biggest reason why the climate is warming at the rate it's going. Right now, The carbon dioxide levels are going way out of control because we are burning so many fossil fuels consistently every day. There is a graph that shows the amount of carbon dioxide ppm, (parts per million) that are in the atmosphere today. This number has rapidly increased since 1960. There was a 350ppm benchmark that hadn't been passed in over 3 million years. We are now at 418 parts per million in 2020 and we are still increasing. There are also things called temperature anomalies which have also been getting warmer and warmer. A temperature anomaly is a difference between an average predicted temperature, and what the temperature actually is. We can see that our temperature anomalies have been consistently getting warmer and warmer than the average predicted temperature every single year. In 2020, we were already 1.82 degrees above the temperature and it was increasing by more every year on a steep upward incline.

All of these side effects of climate change are going to consistently get worse as the years go on. We are constantly burning more and more fossil fuels and we are constantly emitting more carbon dioxide into our air, every year more than the last. The world will never be the same if we keep living this way. If we don't start using renewable energy to power our transportation, electricity, and more, humankind could be in serious danger. It is up to us to fix this. No one else is going to do it for us. We have to realize that we are in serious danger, and at some point, we won't be able to turn this situation around. We have to take action before it is too late, and our home on Earth is destroyed.

"The climate change crisis has already been solved. We already have the facts and solutions. All we have to do is wake up and change." - Greta Thunberg (19-year-old climate change activist).

Proposed Renewable Energy Solution:

The renewable energy source that I would like to add to Portsmouth, NH is solar energy. I would like to put solar panels over parking lots and parking garages that are very open to the sun and are used a lot by the community. Doing this could reduce Portsmouth's carbon footprint and would make us less reliant on fossil fuel usage, which is overall better for the planet. Parking lots and garages with solar panels would be a great place for many electric cars to charge, but instead of being charged and using electricity that is made by burning fossil fuels and releasing carbon dioxide, they could be charged by using solar energy that was made into electricity instead. These parking garages would have to be in the sun so that they could soak in as much solar energy and sunlight as possible. When solar panels get installed the PV Cells in the solar panels soak up all the sunlight that touches the solar panels. Inside those solar panels, the energy is turned into electricity. The solar panels are connected to a control device that is usually on the side of whatever building the solar panels are on top of. This control device takes the electricity from the panels and changes it so that it can power electrical items. From there, the electricity moves from the control device, into a breaker box. The breaker box (which is connected to the control device, and the panels), allows the electricity to flow into outlets in whatever building the panels are on. Now that the solar energy has turned into electricity and has passed through the control device, breaker box, and is now in the outlets, whatever is plugged into those outlets can use that electricity to power electrical items and appliances. In my case, if we added solar panels to parking garages, we could soak up a large amount of sunlight with those panels and it could power all the light in those parking garages, but also buildings around them. This newly generated electricity can also be used to plug in and charge cars if needed. This could also work in regular parking lots on the ground.

Solar renewable energy sources are a better/cleaner alternative instead of using fossil fuels because it produces fewer greenhouse gases that otherwise would end up trapping heat on Earth. The way we create electricity now is, by burning fossil fuels like coal to produce steam. The produced steam flows into a turbine, which spins a

generator to create electricity. Although we have used this process for years, it isn't good for our environment. When we burn coal, we emit carbon dioxide into our atmosphere. So when we leave lights and other electrical appliances on in our house when they aren't in use, we are emitting even more fossil fuels and carbon dioxide into the air than necessary because we keep burning fossil fuels when it isn't nessecary. This means that we could eventually run out. If we use solar energy, it will never run out, and we wouldn't emit any extra carbon dioxide into the atmosphere because we aren't burning anything. The sun also produces around 4,000,000 tons of energy a second. 1 hour of sunlight received by the Earth is calculated to be sufficient to meet our energy needs for a whole year. This means that we have plenty of energy to use that never runs out and is very reliable.

Similar Solutions from Around the World:
In early 2020, China was ranked #1 for the use of solar energy. They have invested a lot in solar energy and solar panels. China has solar farms, (solar panels covering large areas of flat ground in fields), solar panels on houses/roofs, etc. There are also many places around the world that are doing exactly the same thing as my proposal is. Some people may call them "solar canopies" that go over cars in parking lots and garages. Some are curved to create more of a canopy style, some are turned slightly on a diagonal toward whichever way gives off more sunlight, and others are just flat. Any of these designs have been proven to be very beneficial in many areas around the world today. Wherever these solar panel "canopies" are installed, people say they enjoy the shade that they provide as well as the electricity they make. Sources on the web say that "Parking lot solar canopy installations are an excellent installation option for malls, airports, hospitals and other facilities with large parking areas. Not only will you generate green power, but your employees and customers will appreciate the shade to protect their vehicles," and "Solar canopies are an increasingly popular way to take advantage of parking and invest in solar power." Overall, the installation of what are called "solar canopies" wouldn't be a bad way to generate electricity in an eco-friendly way.

Google Map: Enclosed is a link to a Google Earth map that includes specific information and locations for the renewable energy plan.

https://earth.google.com

Project Constraints and Challenges:
Although solar panels placed around downtown over parking lots and garages would be a great way to slow our usage of fossil fuels, it does come with some negatives just like any other solution would. Not one solution is perfect. The first most obvious negative that comes with solar panels would be the fact that they can only work if it's sunny. At night and during days when it may be cloudy, the solar panels won't be able to absorb much sunlight or any at all and won't be able to supply electricity or any power at all for anything. There may be some energy and sunlight left that hasn't been converted yet from the day before, but not much. Another negative that could possibly come with solar panels is the installation process. The construction activities during the installation of large-scale solar power plants can lead to higher levels of air and noise pollution affecting plants and animals of larger communities. Installing these panels requires some knowledge of electrician work so that whoever is installing them can properly handle wiring and other technical aspects of the job. These workers may also have to work in somewhat dangerous areas like on top of a parking garage and possibly working with burying wires. It may be hard to find people that what to do this work.

Importance of Proposed Solution:
Although there maybe a couple of negatives that come with solar panels, they are still 1000x better than using any fossil fuels. Any solution that we can think of will always have some negatives that come with them. I

believe that we should still adopt the idea of solar energy being used in parking lots and garages in the City of Portsmouth. Across New Hampshire, around 50% are still using fossil fuels instead of renewable energy sources to generate our electricity and power. This plan for solar energy in Portsmouth is important because it will allow us to step away from fossil fuels a little bit. If we start with Portsmouth, we could inspire the rest of New Hampshire to follow us in our attempt to stop relying on fossil fuels as much as we are right now. If many countries and cities step away from fossil fuels just slightly, we could greatly slow the production of carbon dioxide. The only way to stop, or at least slow climate change and turn it around, is by slowly making adjustments to the way we are generating our electricity and power now. I believe that solar panels downtown Portsmouth in parking lots and garages will address the problem of human-induced climate change caused by burning fossil fuels.

Project Conclusion:

This renewable energy plan is very important. If we don't stop or at least slow our use of fossil fuels before the year 2030, we could be in serious danger. 2030 is often cited as the year when climate change will become irreversible. By that time, if we don't make a change, we will have produced so much carbon dioxide that is now sitting in the atmosphere trapping heat into the Earth, that we won't be able to come back from it, no matter how hard we try. A scientist has said, "We have 12 years to limit climate change catastrophe," "Planet has only until 2030 to stem catastrophic climate change," and "The world has just over a decade to get climate change under control." This was said a couple of years ago. Now we have less than a decade to get climate change under control. Some of the population has tried to slow the production of carbon dioxide, and some don't even believe that climate change is a real thing. We need to make a change and educate everyone on why we are doing what we are doing, and what they can do to help. This situation can get a lot better, or it could get a lot worse. Again, it is up to us. We can't wait for the next generation, we are the ones who have to turn climate change around in the next 8 or so years. The first step would be to start slowly incorporating things like solar panels into the city. Then we can start doing more after. Let's take the first step, and show the world why we need to change as soon as possible.

"Climate change is real. It is happening right now, it is the most urgent threat facing our entire species and we need to work collectively together and stop procrastinating." -Leonardo Di Caprio, Actor, and Environmentalist.

Renewable Energy Proposal - 2030
City of Portsmouth
Prepared by Ginger Vinciguerra
April 1, 2022

Project Narrative:

Our planet Earth, home to human livelihood and ecosystems is significantly changing adversely. A change in which temperatures are rising. Influencing this negative shift is climate change. Climate change is a concern in which our planet is warming at an accelerated rate due to the elevating levels of carbon input. By carbon input I'm referring to any process that uses fossil fuels. When burning fossil fuels to produce energy, greenhouse gasses and nitrogen oxide are emitted into the atmosphere. When these gasses enter the atmosphere they preoccupy infrared radiation released from the Sun. This process is the main factor to the warming of Earth's surface and atmosphere. This agitation is exceedingly increasing droughts, wildfires, and the rise of sea levels.

The concern of the increase in droughts, wildfires, and the rise of sea levels is only growing. By 2050 it's predicted that in the U.S., the total energy related carbon emissions will be about 4,807 million metric tons. That's around 5% more than in 2020. If the U.S. keeps emitting carbon dioxide by burning fossil fuels at such a rapid rate then we will begin to face more permanent challenges. Issues such as frequent droughts, wildfires, flooding/rising sea levels, coastal erosion, hurricanes, shift in rainfall patterns, and temperatures rising. For example sea levels used to rise at a yearly rate around 0.06 inches and now sea levels are rising about 0.14 inches per year.

Living in Portsmouth, New Hampshire we are impacted by the rise of sea levels. Some day in the future Portsmouth could be underwater. Coastal regions can and will be affected by the rise of sea levels. Some small island nations have already been destroyed by climate change. Located in the Pacific Ocean is the Marshall Islands. As of today this nation is endangered due to the rise in sea levels. The Marshall Islands will be submerged by 2035 if we keep emitting more carbon dioxide. Climate change is dismantling the environment. Although climate change may not be directly affecting you currently, think about how it is going to negatively affect generations to come. A sustainable world for all living organisms, it is slowly fading away.

Proposed Renewable Energy Solution:

To liberate our world from climate change we all must take initiative and act urgently. My proposal for Portsmouth, New Hampshire is to implement "solar trees" throughout the downtown area of Portsmouth. This structure, referred to as a solar tree, converts solar radiation into electricity. Solar radiation is waves of energy emitted from the sun. As this sunlight radiates down towards Earth it can be converted into energy. Instead of wasting this energy we can implement solar panels to transfer the sun's radiation into electricity. Solar panels are devices made of a collection of solar(photovoltaic) cells. The photovoltaic cells inside the solar panel help to absorb the sunlight. Then electrical charges begin to move, creating electricity or heat. Solar panels are placed throughout the world.

Solar trees are tree-like structures with solar panels along it. These "trees" are made out of metal or stone with "branches" holding solar panels. I've thought of three beneficial locations where Portsmouth could place solar trees. These locations are all in populous areas of downtown Portsmouth. The first location is in front of the North Church in Market Square. Placing a solar tree in front of the North Church would gather attention to renewable energy to the community of Portsmouth. People of all ages walk, drive, or bike past the

North Church everyday. This solar tree could also help power the surrounding business. Also many musicians perform in that area, so the solar tree could help to power their electrical equipment.

Another location where a solar tree could be placed is in the grass area north of Memorial Park. The area near Memorial Park would be an eye-catching place to put the solar tree. Many cars and walkers would pass this solar tree on a daily basis. Also it could help to power the bridge or surrounding businesses.

The final location I planned is Prescott Park. Placing a solar tree in Prescott Park could help power the fountain there or help local festivals power their electrical needs. It could also help power the snack shack there. These three locations would be a good foundation for implementing solar trees in Portsmouth. Potentially, Portsmouth could place more solar trees throughout the city. Places such as the Portsmouth Public Library, Portsmouth Public Schools, and other public areas. My goal is to have solar trees implemented throughout the entire City of Portsmouth.

Google Map: Enclosed is a link to a Google Earth map that includes specific information and locations for the renewable energy plan.
(https://earth.google.com/earth/d/1fNBsI2ykeAtj4OHuvvMlEZyiOC6pY4Jm?usp=sharing)

Similar Solutions from Around the World:

There are some other countries and states that have implemented solar trees. Florida has solar trees installed in zoos, museums, airports, and parks which is similar to what I'm proposing for the City of Portsmouth. Thanks to the solar trees installed around Florida now over 50 million people have been introduced to solar power. Not only do the people of Florida appreciate the electricity the solar trees provide but it also provides shade.

Located in Singapore's Bay South Garden is 18 "supertrees". These trees vary in height from 25 meters to 50 meters. This eco-tourist destination provides renewable energy to some parts of Singapore. The supertrees help control temperatures, collect rainwater, and generate renewable energy. The outstanding innovation of the supertree has further evolved Singapore into becoming the "city in a garden". Singapore's energy story is inspiring for the whole community. By 2035 Singapore plans to import 30% of their energy from low carbon sources.

Smart Palm Trees have been installed in Dubai. The Smart Palm Tree is a structure shaped like a palm tree with leaves made out of solar panels. These trees include features such as solar panels, an emergency system, a Wifi source, touch screens, info screens, and charging stations. The Smart Palm Tree has not only benefited the environment and public but it's gathered money for the city by charging fees for using it's Wifi. Also it projects information from the government, daily news, and other public information using its info screens. Another benefit of the Smart Palm Tree is it charges electronics 2.5 times faster than a normal charging station. During the day the tree stores enough energy to take place as a street lamp throughout the night. Overall, since 2015 these trees have produced 15,203 kWh of power and charged 353,944 devices. The relatively new innovation of the solar tree has been placed all over the world.

Project Constraints and Challenges:

Despite all the amazing benefits solar trees provide, there are some challenges to my vision. The first obstacle being the finance challenges that come with investing in the solar tree. Solar trees can cost from $30,000 to $100,000. The price depends on the size of the tree and its features. On top of the financial struggle, solar trees don't provide as much energy as rooftop solar panels. An issue with solar panels in general is their ability to store enough energy on days with less sunlight. This source of energy is truly weather dependante. The solar industry's biggest issue is market uncertainty. Almost everything in life comes with negatives, but I think the benefits of solar energy overrides its negatives.

Importance of Proposed Solution:

Even with the challenges listed above, the solar tree is an environmentally friendly source of renewable energy. Solar trees placed around Portsmouth could provide electricity, charging outlets, Wifi, street light, touch screens, etc depending on the design of the tree. Most importantly, the solar tree gathers awareness towards renewable energy from the public. The intricate design of the tree sets it apart from rooftop solar panels. People and especially children are more likely to pay attention to something visually interesting like a tree made out of solar panels than a building with rectangular solar panels sitting on top of it. With the solar tree people are able to witness solar up close.

The solar tree makes solar energy more accessible. When implementing a solar tree with charging stations and Wifi the community can instantly and directly experience solar energy. By allowing the public to actually use solar energy will further inspire them to invest in solar energy and start thinking about what they can do to end climate change. These trees will introduce renewable energy to the City of Portsmouth.

Project Conclusion:

Adding solar trees in Portsmouth may be a small solution to climate change but the small actions add up. The solar tree will help transform Portsmouth to becoming more sustainable. Putting solar trees in downtown Portsmouth would begin to transform Portsmouths usage with renewable energy. Even just implementing one solar tree would make a difference. I believe that placing solar trees around Portsmouth is a doable task and an important one. If we don't take action this rate of carbon emissions will only increase. Our world is suffering and will only continue if we don't take action now.