

Jadyn Johnson  
Waukee High School  
Waukee, IA, USA  
Oman, Renewable Energy

## **Oman: A Transition to Renewable Energy for a Sustainable Future**

The Sultanate of Oman is located in the Southeast Arabian Peninsula on the western edge of Asia. Oman ranks 41st among the world's 195 countries in terms of wealth. Oman is also ranked 68th for the chief economies of the world (World Data Info). Oman's economy is stimulated by their mass exportation of petroleum products, totalling \$20.09 billion in 2020 alone (Observatory of Economic Complexity). The overuse of such a destructive and debilitating harvest of petroleum for energy has and will continue to harm not only the people of Oman, but their land and the Earth as well. The type of energy required to harvest such oils uses a great deal of energy that at this moment is nonrenewable. This is why I am proposing a solution to Oman's renewable energy problem. I believe that implementing sustainable and renewable energy as a major source of Oman's energy will greatly benefit the country and help sustain the Earth as well.

As a fairly small country, totalling almost 119,499 square miles, it is comparable to the slightly larger Poland and double the size of the state of Georgia in the United States. Unlike Poland and Georgia however, Oman has a subtropical or hot desert climate. Oman is known for its extreme dryness, averaging only 9 inches of rainfall in the north per year. The annual temperature since 1991 has been recorded at 27.69 Celsius (82 F). There are over 4.6 million people populating the country, around 87 percent living in urban areas and 13 percent in rural locales ("Oman" Climate Change Knowledge Portal). As of 2019, 33.8 percent of Omanis live in villas, large and luxurious homes. 28.9 percent live in flats, similar to apartments, and another 24.1 percent live in Arabic housing which is a stone house built around a center courtyard. A very small 0.6 percent of Omani's live in villages in rural areas. The last 12.5 percent live in a range of other housing options from mud-brick to mansions ("Sultanate of Oman" National Centre For Statistics and Information). Contrary to most countries in the world, Omani women on average make more money than men. The average wage for females is 805.8 Omani Rial (\$25,114 USD) and the average wage for males is around 572.4 Omani Rial (\$17,839 USD). Meanwhile the poor make an average of 558 OMR (\$1,449.31 USD), and the wealthy up to 7,800 OMR (\$20,259.18 USD) per month. While these numbers seem small for an income in the United States, it makes for an adequate to upscale living in Oman.

Almost every family in Oman has access to clean water, phones, roads, electricity, toilet facilities, and local markets. These are vital things that contribute to a healthy and fulfilling life. Diet in particular is indispensable to the wellbeing and development of a person. The typical size of a family in Oman is around 5-6 people consisting mostly of the parents and children with exceptions just like here in the United States. However throughout the day the typical Oman household has gardeners, housekeepers, and cooks who rotate through the home as well. Just about every child in Oman has access to school and education and on a typical day that is where the children would go while adults are at their jobs. There are many different lifestyles, but education and family are the most important values in Omani families. In Oman, lunch is a very important meal. Families will gather at lunch time for a large meal, whereas

breakfast and lunch are smaller meals eaten together or separate (Youth For Understanding). The typical Omani diet consists of around 20 percent meat and poultry, 16 percent fruits and vegetables, 12 percent grains and cereals, and 10 percent milk and eggs, and the remaining split in different categories such as fish, sugar and honey, along with fats and oils (“Sultanate of Oman” National Centre For Statistics and Information). Farms contribute greatly to the diets of Omanis. Currently there is only one certified organic farm in Oman, Pairidaeza, or Paradise, located in Barka. And with every other farm using conventional methods, it poses the question, will Oman have enough renewable energy to create sustainable farms that control food security for the people of Oman for decades to come? Or will Oman eventually run out of unrenewable energy and be left scrambling to provide adequate food to their citizens, ensuring that people’s essential needs are met?

Home to mostly desert landscapes, Oman is ripe with possibilities. However there is a major discrepancy that could be solved when it comes to renewable energy in Oman. Almost 80 percent of energy produced and used in Oman comes from fossil fuels. Only 2 percent of the energy is renewable and stems from solar panels (International Renewable Energy Agency). The overuse of such a destructive and debilitating harvest of energy has and will continue to harm not only the people of Oman, but their land and the Earth as well.

When considering the best options for renewable energy in Oman there are some obvious criteria that need to be met to create the most efficient system. Hydroelectricity for one would be implausible as Oman has a fairly dry climate. But Oman also endures the monsoon season and tropical cyclonic storms, meaning that any solution for renewable energy, at least on the coast, must be capable of withstanding extreme weather conditions. According to the International Renewable Energy Agency the best fit for Oman in renewable energy is wind and solar energy. Oman has the capacity to run on 73 percent solar energy and 27 percent wind energy. Oman could also potentially use biofuels instead of fossil fuels and look into harnessing energy from the ocean via waves.

The reason that renewable energy is so important is because unrenewable energy has extremely harmful effects on the planet and eventually they will run out. One reason they are so harmful is because a great deal of them come from long ago deceased beings that are being harvested and mined from the Earth. We have already taken so much that now we are forced to dig, drill, and mine even deeper to reach fossils from thousands to millions of years ago. Another is because they release toxic emissions and create a great amount of air pollution that is very dangerous for people to inhale. The fossils are then turned into fuel that we can use to power a multitude of things. But the Earth has only been around for so long, around 4.5 billion years and the beginning of life itself is only 3.7 billion years old (University of Chicago). This means that eventually fossil fuels, which make up roughly 80 percent of the world’s energy (Environmental and Energy Study Institute), will run out, and it's all in a matter of decades until we see the last of it (Millennium Alliance for Humanity & the Biosphere, Stanford).

Oman is in the top 35-39 percent of countries with the largest fossil fuel production and stores. Oman is the 18th largest producer of oil in the world, harvesting around 1 million barrels per day and the 20th ranking country producing natural gasses with 36.9 billion m<sup>3</sup> produced every day as of 2020 (World Population Review). Oman’s reliance on fossil fuels and even oil and gas in general isn’t something to be easily remedied. The economic stability needed for a country to operate is great, and for Oman, most of

its economy is dominated by the sale of oil and gas. I propose that Oman continues to lower their reliance on gas and oil sales. From 2000 to 2010 Oman was able to reduce their reliance on gas and oil by 2.7 percent (International Renewable Energy Agency). If Oman continues to diversify their economic market to export greater services, agricultural goods, and industry manufactured items they could lessen their reliance on fossil fuels.

Oman might not be considered a top producer of agricultural goods, and by no means should they be, but Oman has a great potential for expansion in the agricultural market. The top agricultural exports that Oman could expand on even more are pulses (lentils, peas, dried beans, and chickpeas), livestock, and grains (Knoema, World Data Atlas). If Oman doesn't transition away from a heavy reliance on gas and oil exports, currently 76 percent of the country's economic dependence, Oman will continue to produce fossil fuels (Carbon Tracker Initiative). Fossil fuels are contributing to a massing of greenhouse gasses in the atmosphere which in turn is leading to a great change in the climate of the Earth. The greenhouse gasses are annexing to a warming of the climate which is in turn leading to heat waves, increased floods, and tropical cyclones among a few (United States Environmental Protection Agency). Oman already suffers from tropical cyclones and drought seasons, also adding in the rise in temperatures, Oman is estimated to reach an average temperature of 48.62° Celsius or 119° Fahrenheit in just 60 years. Oman is at great risk if no measures are taken to prevent the current estimation for the future, which is why renewable energy is so important.

I propose that Oman convert to using renewable energy instead of burning fossil fuels. This is a massive undertaking, so I have come up with multiple steps. The first step is to educate the Sultan of Oman, Haitham bin Tariq and the rest of the Oman government. Then spread the knowledge of what renewable energy could mean for the country to the citizens. The second step is to survey the country and assess the land for the most opportune areas to implement solar fields and wind turbine farms. My third step is to create a plan of action that will make the solar and wind energy agents possible and plausible. The last step is to execute the plan by installing solar and wind harnessing methods all around the country.

Educating. The very first step is to educate the people of Oman on why and how they can move towards renewable energy. This can be a very difficult task as Oman's economy is largely supplied by their exports of fossil fuels. That is another task to tackle as well, but there are solutions that can be exacted now and further in the future regarding their harvesting of finite resources for nonrenewable energy. Such as capturing the CO<sub>2</sub> released when harvesting oil and pressurizing it to then release it back into the oil reservoir instead of out in the atmosphere as it is highly unlikely for a country who's exportation of fossil fuels is cardinal to their economy to realistically halt operations ("Why are Fossil Fuels so Hard to Quit?" Brookings). That is why I propose to educate at the government level about the statistical harm to Oman now and in the future as their main source of energy is from a finite source that is contributing to the deterioration of their environment and the Earth. Then move on to the citizens of Oman and push that there is a solution that is beneficial and can be implemented sooner rather than later so that effects are tangible. Just about everyone in Oman has access to the internet, so why aren't they already pushing for change? Well they are, a plan has been put in place, but it will be years before anything will begin. Which is why I am presenting my own ideas in a pragmatic plan for a solution.

Assessing. The next step that I suggest is to assess where the best place to set up solar and wind energy gleaners would be. There are multiple different ways to harness the energy of the sun such as photovoltaic (solar) panels, thermal heaters, solar water heaters, molten salt thermal energy, and solar water vacuum heaters. These all need relatively sunny areas, but are used for different purposes. It is recommended that the solar farms be set up along the coast to ensure a longer lifespan (“Selection of the best solar photovoltaic (PV) for Oman” Research Gate). Oman has 1,967 miles of coastline, so I recommend assessing which areas along the coast are optimal for solar fields to harness the most energy. The other options can be made for commercial, personal, and other uses that help integrate solar energy into Oman society and largely reduce the amount of unrennewable energy consumption. As for wind energy, offshore might just be the best option. Not as commonly thought of, wind turbines offshore can be much larger, enabling them to receive more wind power in the open waters (“Top 10 Things You Didn’t Know About Offshore Wind Energy” Energy Efficiency & Renewable Energy). This also allows for more turbines as they won’t encroach on Omani’s on land. Offshore wind turbines are headed to become the new normal for wind turbines as it was found they are much more efficient and harness more energy (Green Coast) Oman will be headed towards the future with the implementation of renewable energy and fast tracking offshore wind turbines.

Planning. The third step that I have come up with is creating a SMART plan. This SMART plan ensures that it is specific, measurable, attainable, relevant and timely. The implementation of solar and wind energy needs to be specific or exact in its detailing to assure that it can go as according to the plan as possible. Working with the government and large solar and wind companies will help the plan to go smoothly and be the most efficient it can be. The effect of the incorporated renewable energy needs to have a measurable impact that shows the benefits for Oman. Attainability is a very important aspect of the plan, if the goals are too big at the start, it lessens the probability of renewable energy to be utilized and furthered upon. Relevancy to renewable energy is important because you don’t want to steer away from the most important parts by being distracted by other things. Sticking to the basics until there is a rooted system that can then be built upon. This logic works with time as well, to implement the plan as quickly as is responsible to do so. By sticking to the plan to introduce renewable energy into Oman through solar and wind energy in a couple of years after finding funds, the right machinery, and the proper technology, renewable energy could become more than just an idea for Oman, it could become reality.

Enacting. The last step is to put the plan into action by putting all of the pieces together. All of the different resources, Omani government and citizens, and contractors will work together to carry out the plan to build offshore wind turbines and to set up solar panels along the coast. My plan heavily relies on cooperation and teamwork between those who know how to create and the leader of Oman to handle the logistics of adding such a large renewable energy source to the country. This plan will require contractors to build and develop solar and wind energy harvesters that are the best for conditions in Oman. There could definitely be setbacks and flaws to the plan, but as long as there is a start, there can be a final product through trial and error and perseverance. As long as the people of Oman’s attention is brought to the critical need for renewable energy for sustainable development I believe that however long it takes, there will be a change for the betterment of the future.

Another impact that renewable energy can have on Oman that might not be as commonly thought of is its effect on agriculture. Conventional agriculture in general, a practice that Omani farmers use now is shown

to be a leading cause of soil erosion, water pollution, and leads to an increase in greenhouse gas emissions. Organic farming with the aid of renewable energy sources though can help to eliminate some of these harmful factors. This is because organic farming creates a vitalized soil culture, it fills the environment back up with clean air and water and eliminates noxious fertilizers and pesticides. (“Organic vs Conventional” Rodale Institute) By “integrating off-grid or distributed renewable energy (DRE) sources as part of local food systems [it] can only add to that and reinforce the positive perceived value,” states Sergio Rivero Achá, the officer of Energy and Environment at UN-FAO in an article by Power For All. He explains the importance of renewable energy in all parts of the food system, using less nonrenewable energy to power farms, manufacturers, producers, and more is actually a cheaper alternative and can lower the cost of goods for consumers. In the same Power For All article, Victor Lesniewski, the Chief Operating Officer of Khethworks says that “When farmers have the confidence that their energy source will be reliable and affordable in the long run, they can have the confidence to make changes and investments in their irrigation and agricultural practices and infrastructure to increase their cultivation, productivity, and income generation.” This helps to contribute to food security, the cheaper the food and the more reliable a constant source, the more likely it is for Omanis to have more access to all sorts of sufficient and nutritious food that will provide physical, social and economic benefits.

In conclusion, there is a big issue in Oman surrounding their source of energy that is produced and consumed, it is unsustainable. By transitioning to a more sustainable and environmentally friendly way of harnessing natural energy instead of digging up the Earth for a hazardous and finite nonrenewable energy there is a possibility that Oman will have enough resources to create a sustainable system. This applies to many areas of the county of Oman, from their economy to agriculture and even to individual families where the impact will be felt in generations to come. It is important for the change at the government level, but also for individual families to create their own renewable energy systems. Renewable energy is a step toward a greener future, which will create more opportunities and a better quality of life for Omani families in ensuing years. Setting up a solar and wind harnessing system can trickle down into Oman’s agriculture to create a continuous supply of energy that will allow farmers to meet basic food security needs and expand upon them. Renewable energy can also help to clean up the damage created by fossil fuels and steer Oman towards a bright future. Renewable energy hopefully is the future for Oman, with wind and solar energy as the solution.

## Works Cited

- Abdul-wahab, Sabah, and Yassine Charabi. "Selection of the best solar photovoltaic (PV) for Oman." *Research Gate*, August 2019, [https://www.researchgate.net/publication/334842488\\_Selection\\_of\\_the\\_best\\_solar\\_photovoltaic\\_PV\\_for\\_Oman](https://www.researchgate.net/publication/334842488_Selection_of_the_best_solar_photovoltaic_PV_for_Oman). Accessed 23 March 2023.
- Climate Change Knowledge Portal. "Oman - Climatology | Climate Change Knowledge Portal." *Climate Change Knowledge Portal*, 2021, <https://climateknowledgeportal.worldbank.org/country/oman/climate-data-historical>. Accessed 23 March 2023.
- Coffin, Mike, and Andrew Grant. "Beyond Petrostates." *Carbon Tracker Initiative*, 11 February 2021, <https://carbontracker.org/reports/petrostates-energy-transition-report/>. Accessed 20 September 2023.
- Environmental and Energy Study Institute. "Fossil Fuels | EESI." *Environmental and Energy Study Institute*, 22 July 2021, <https://www.eesi.org/topics/fossil-fuels/description>. Accessed 23 March 2023.
- Environmental Protection Agency. "Setting and Reviewing Standards to Control Particulate Matter (PM) Pollution | US EPA." *EPA*, 6 February 2023, <https://www3.epa.gov/region1/airquality/pm-aq-standards.html>. Accessed 23 March 2023.
- Gross, Samantha. "Why are fossil fuels so hard to quit?" *Brookings*, June 2020, <https://www.brookings.edu/essay/why-are-fossil-fuels-so-hard-to-quit/>. Accessed 23 March 2023.
- International Renewable Energy Agency. "Home." *YouTube*, 11 April 2019, [https://www.irena.org/-/media/Files/IRENA/Agency/Statistics/Statistical\\_Profiles/Middle%20East/Oman\\_Middle%20East\\_RE\\_SP.pdf](https://www.irena.org/-/media/Files/IRENA/Agency/Statistics/Statistical_Profiles/Middle%20East/Oman_Middle%20East_RE_SP.pdf). Accessed 23 March 2023.
- Knoema. "The exports of crops from Oman - knoema.com." *Knoema*, 2021, <https://knoema.com/data/oman+foreign-trade-exports+crops>. Accessed 20 September 2023.

Koppes, Steve. "The origin of life on Earth, explained | University of Chicago News." *UChicago News*, 19 September 2022, <https://news.uchicago.edu/explainer/origin-life-earth-explained>. Accessed 23 March 2023.

Kottadiel, Divya, and Benson Kibiti. "Renewable energy and food security." *Power for All*, 15 October 2020, <https://www.powerforall.org/insights/impact/global-local-building-energy-smart-local-food-systems-post-covid-era>. Accessed 23 March 2023.

McCloy, John. "Onshore vs Offshore Wind: What Are the Differences and Facts?" *Green Coast*, 17 September 2019, <https://greencoast.org/onshore-vs-offshore-wind/>. Accessed 23 March 2023.

Millennium Alliance for Humanity & the Biosphere, Stanford. "When Fossil Fuels Run Out, What Then?" *MAHB*, 23 May 2019, <https://mahb.stanford.edu/library-item/fossil-fuels-run/>. Accessed 23 March 2023.

National Center for Statistics and Information. *Untitled*, March 2020, [https://www.ncsi.gov.om/Elibrary/LibraryContentDoc/ben\\_En%20HOUSEHOLD%202020\\_bc5c8ea1-974e-490f-a71b-221f2dfac242.pdf](https://www.ncsi.gov.om/Elibrary/LibraryContentDoc/ben_En%20HOUSEHOLD%202020_bc5c8ea1-974e-490f-a71b-221f2dfac242.pdf). Accessed 23 March 2023.

Observatory of Economic Complexity. "Oman (OMN) Exports, Imports, and Trade Partners | OEC." *The Observatory of Economic Complexity*, 2020, <https://oec.world/en/profile/country/omn>. Accessed 23 March 2023.

Rodale Institute. "Organic vs Conventional." *Rodale Institute*, 2023, <https://rodaleinstitute.org/why-organic/organic-basics/organic-vs-conventional/>. Accessed 23 March 2023.

Wind Energy Technologies Office. "Top 10 Things You Didn't Know About Offshore Wind Energy." *Department of Energy*, 16 August 2022, <https://www.energy.gov/eere/wind/articles/top-10-things-you-didnt-know-about-offshore-wind-energy>. Accessed 23 March 2023.

WorldData.info. "Economics in Oman compared to the EU." *Worlddata.info*,

<https://www.worlddata.info/asia/oman/economy.php>. Accessed 23 March 2023.

World Population Review. "Oil Production by Country 2023." *World Population Review*, 2021,

<https://worldpopulationreview.com/country-rankings/oil-production-by-country>. Accessed 23 March 2023.

World Salaries. "Average Salary in Oman for 2023." *World Salaries*, 2023,

<https://worldsalaries.com/average-salary-in-oman/>. Accessed 19 September 2023.

Youth for Understanding. "Student Life Cultural Profiles by Country.indd." *Student Life Cultural Profiles*

*by Country.indd*, [https://online.yfuusa.org/media/yes\\_lounge/Oman.pdf](https://online.yfuusa.org/media/yes_lounge/Oman.pdf). Accessed 23 March 2023.