**Brainstorming and Problem Statements**

**Renewable Energy Systems in Nigeria**

Need to know:

* Cause of frequent power outages in Nigeria, main power supplies, what alternatives could be used to harness energy (solar-lots of sun there), climate of Africa
* How to harness and convert natural sources to electricity
* Is debris on solar panels an actual issue? But can this still be applied to broader renewable energy?

Know:

* Debris is an issue on solar panels
* Shade on solar cells can TLDR cause shorts
* Keep costs down

Ideas:

* Remove debris from solar panels
* self-cleaning panels?
  + Subsystems: Glass coating, detection, actual cleaning, cleaning solution environmentally stable?

Problem Statement: (State/Symptoms, Impact of solution, users/stakeholders, definition of success, not solutions)

Almost half of Nigeria’s population does not have access to power, and even when it is accessible, it is not of the best quality. Nigeria also has an overdependence on fossil fuels. They have an abundance of renewable resources for energy but they lack the resources and the system is not adequate enough to utilize those resources. Solutions to this lack of sustainable energy would be able to reach the demand of their policies, the economy would boost productivity in agriculture and overall life, and access to more resources. The people who would most likely be affected by this are Citizens of Nigeria, more specifically residential consumers, energy providers, environmental organizations, government, and research institutions. What would make this project a successful one is If the overall percentage of people with access to well-functioning electricity/power increased. Some innovative opportunities to help deal with the problem could be expanding the use of solar power by installing solar panels on rooftops, solar mini-grids, and utility-scale solar farms. There is even the possibility of a self-cleaning solar panel because the dry climate of Nigeria could allow dust to settle on the solar panels, making it harder for sunlight to reach it. Harness wind energy in the coastal regions. We could also explore hydropower and geothermal energy for electricity generation.

Resources/References

* Vulturius, G., & Tuhkanen, H. (2020). *Matchmaking power: expanding climate finance for off-grid solar electricity*. Stockholm Environment Institute. <http://www.jstor.org/stable/resrep25062>
* <https://www.rst-cleantech.com/>
* Bilotta, N., & Colantoni, L. (2018). *Financing Energy Access in Sub-Saharan Africa*. Istituto Affari Internazionali (IAI). <http://www.jstor.org/stable/resrep19690>
* [Nigeria to Keep the Lights on and Power its Economy (worldbank.org)](https://www.worldbank.org/en/news/press-release/2020/06/23/nigeria-to-keep-the-lights-on-and-power-its-economy#:~)
* [Energy and sustainable development in Nigeria: the way forward | Energy, Sustainability and Society | Full Text (biomedcentral.com)](https://energsustainsoc.biomedcentral.com/articles/10.1186/2192-0567-2-15)
* [Electricity in Nigeria – Issues, Solutions and Risks - Sun Connect News (sun-connect.org)](https://sun-connect.org/electricity-in-nigeria-issues-solutions-and-risks/)

**Water Pollution in the Context of Oil Spills**

Need to know

* Specific locations that are being affected
* How large the spills are
* What materials are waterproof and non-harming to water

Know:

* Oil skimmers get frequently clogged with debris
* Agricultural runoff causes pollution

Ideas:

* Filters
* Self-cleaning filters
* Food processor attachments to oil skimmer
  + Subsystem: Processor attachment, Skimmer, Oil/debris detection

Problem Statement: (State/Symptoms, Impact of solution, users/stakeholders, definition of success, not solutions)

Oil skimmers are devices used to remove hydrophobic liquids such as oils and grease from the surface of the water. These are commonly used to clean-up globally-occurring oil spills, which is a laborious and expensive task, yet it is necessary to clean-up to mitigate the harm to our oceans and coastal ecosystems. The biggest problem with oil skimmers is how they can be jammed by debris that is sitting on the surface of the oil. To address this, this team proposes to design an oil skimmer with some sort of filter or “food-processor like” modification that can either catch or break apart debris on the oil preventing these devices from becoming jammed.

Resources/References:

* <https://oceanservice.noaa.gov/facts/spills-cleanup.html>
* https://www.epa.gov/oil-spills-prevention-and-preparedness-regulations
* <https://www.oilandwaterdontmix.org/problem>
* https://www.oilskim.com/blog/the-better-belt-skimmer-solving-the-issues-customers-experience-with-traditional-belt-skimmers#:~:text=%E2%80%9CThe%20oil%20skimmer%20belt%20is,oil%20from%20reaching%20the%20belt

**Drinking Water Treatment** (Implement advanced technologies to remove pollutants from industrial and municipal)

Need to knows:

* What areas have issues
* What’s preventing water from being treated up to high standards

Know:

* Ex: Flint MI, lead pipes, need the right chemicals and the right balance, lots of infrastructure is very old,
* California droughts have caused the need for wastewater to be treated to become drinking water.

Ideas:

* Pipe lining system
* Any sort of improved pre-filter to make the rest of the drinking water treatment process easier
* Home/personal/portable system
* Water collection and pre-filtering
  + Collect from roof
  + Subsystems: roofing, gutter, collection, filtering, storage,
* Water saving
* Water reuse
  + Collect water from washing dishes, filter it to reuse (water plants, etc.)

- Create better measurement instruments to measure contaminants

Problem Statement: (State/Symptoms, Impact of solution, users/stakeholders, definition of success, not solutions)

As our climate rapidly gets warmer, fresh water sources continually get scarce due to rapid droughts and pollution. The symptoms of a lack of clean drinking water are a rise in mortality rates, especially during heat waves, and increase in sickness and hospitalization year round. A solution to this problem would result in a positive impact on resident health. The users of drinking water treatment would be humans and animals (i.e. domestic pets). Stakeholders would be local, state, and federal governments within the USA. The success of our solution would be defined in creating clean drinking water of a great quality that prevents harm to the human body. One such innovation would be filtering soap and grime from dish sinks, shower drains, etc to recycle the water from the necessities of modern life.

Resources/References:

[Engineering Solutions | Water for all (mit.edu)](http://12.000.scripts.mit.edu/mission2017/solutions/engineering-solutions/)

[Engineering Sustainable Solutions to the Water Crisis — Purdue Engineering Online](https://engineering.purdue.edu/online/news/engineering-sustainable-solutions-to-the-water-crisis)

Derrington, E. (2011). Drinking Water in the United States: Are We Planning For a Sustainable Future? *Consilience*, *6*, 63–90. <http://www.jstor.org/stable/26167817>

Smith, A. H., & Steinmaus, C. M. (2011). Arsenic in drinking water: Increases deaths from cardiovascular disease. *BMJ: British Medical Journal*, *342*(7806), 1036–1037. <http://www.jstor.org/stable/23049710>