Engineering Challenge: Identifying Viable Alternative Energy Sources

Our team's problem focuses on identifying alternative energy sources that are viable, scalable, and realistic in terms of cost and infrastructure. Below are five distinct concepts that approach the problem from different angles. Not all of them are equally practical, but the goal here is range and creativity.

Neighborhood Solar Microgrid System: Instead of every house operating independently, a neighborhood could function as a shared solar microgrid. Rooftop solar panels would feed into a centralized battery storage system (around 200–400 kWh capacity depending on the number of homes). A smart inverter system would distribute energy based on real-time demand.

A typical Texas home consumes about 1096 kWh per month, so grouping 10–20 homes together would allow energy balancing across the neighborhood. If one home produces excess energy, another can use it. During outages, the neighborhood could temporarily disconnect from the main grid.

This solution reduces infrastructure strain and improves reliability compared to isolated systems.

Hybrid Residential Wind + Solar System: Solar energy is strong during the day, but wind can be stronger at night or during storms. A hybrid system combines rooftop solar panels (6–10 kW) with a small vertical-axis wind turbine (3–5 kW, ~30–40 ft tall).

The system would use a hybrid charge controller to manage both inputs into a shared battery storage unit. In open areas of Texas where wind averages 9–13 mph, this setup could operate efficiently.

The advantage here is reducing dependence on one variable energy source. If solar output drops, wind can compensate.

Expanded Geothermal Heat Pump Systems: Instead of only generating more electricity, another approach is reducing total demand. Shallow geothermal systems use underground temperatures (~55–70°F) to regulate building heating and cooling.

Pipes buried 6–10 feet underground circulate fluid to transfer heat into or out of the home. This can reduce HVAC energy use by 30–60%.

This solution is less visible than solar or wind but improves efficiency long-term and reduces strain on the grid.

Small Modular Nuclear Reactors (SMRs): Large nuclear plants are expensive and slow to build. Small modular reactors (50–300 MW) could provide consistent baseline power while reducing construction timelines.

SMRs are factory-built, transported to site, and designed with passive safety systems. Compared to solar or wind farms, they require less land area and provide steady output regardless of weather.

Challenges include regulation, cost approval, and public perception, but in terms of reliability, this is one of the strongest alternatives.

Energy-Generating Public Gym (Ridiculous but Interesting): This idea is partially serious and partially not. Imagine a public gym where all exercise machines are connected to generators. Each treadmill or bike could produce around 100–300 watts depending on effort.

Energy would feed into a battery bank to power lighting or small buildings. While this would not scale to city-level power production, it could offset local energy use and promote public health at the same time.

It is unrealistic as a primary solution, but it highlights how kinetic energy recovery could be integrated into everyday systems.