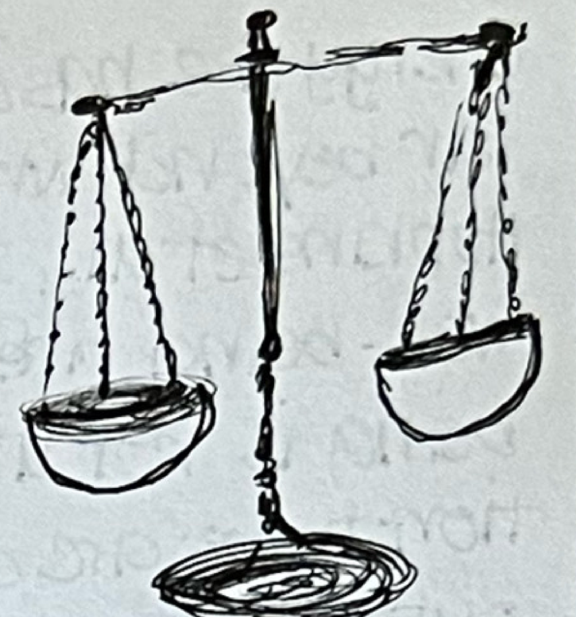
A 'JUST' ENERGY TRANSITION:



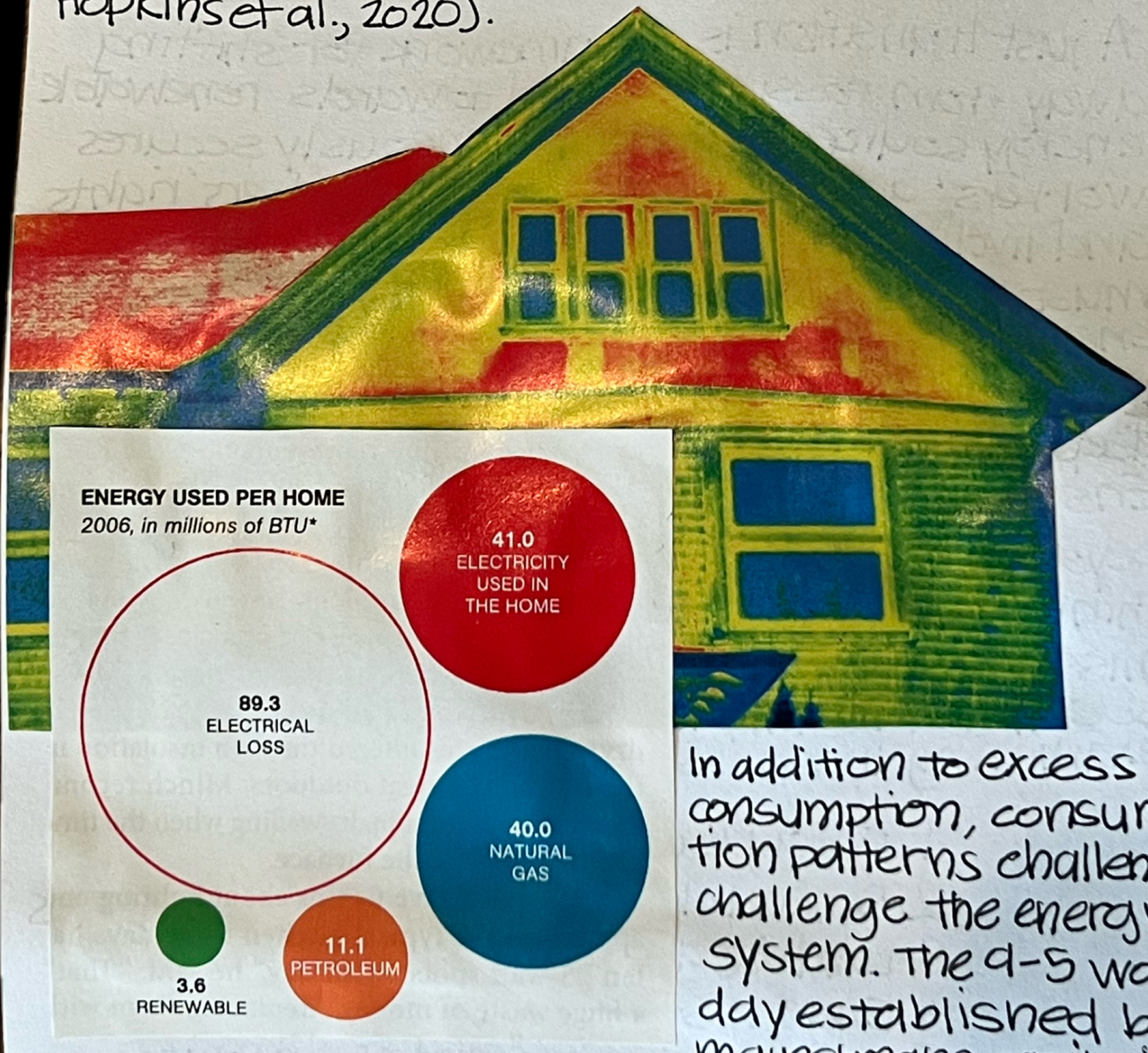
Issues Facing the State + Beyond

A just transition is a framework for shifting away from fossil fuels and towards renewable energy sources that simultaneously secures workers' and local community members' rights and livelihoods. The benefits of this transition must be distributed widely and equitably. Our energy system is a socio-technical system: the social and technical infrastructure are deeply embedded and inextricably linked. Ensuring a 'just' transition for California and beyond requires a nuanced, holistic plan. This means thinking about each stage—generation, transmission, distribution, and end use, from both social and technical perspectives. We begin to examining these issues, starting with:

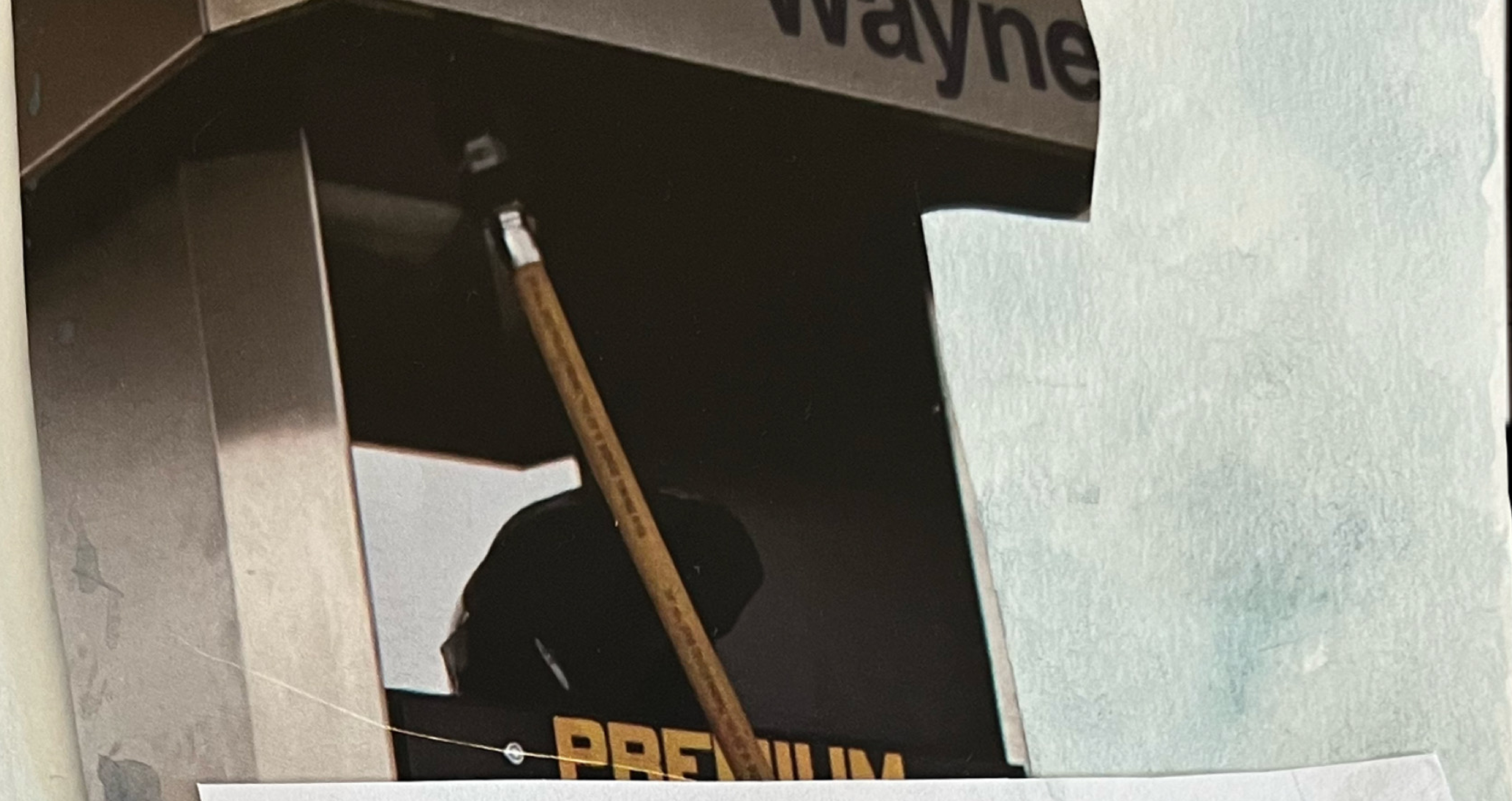
1. Energy Use and Consumption Habits
2. Renewable Sources and Their Limitations
3. Land Use and Land Use Conflicts
4. Energy Storage
5. Utility Companies and Their Power

By Leah Likin, Molly Erwin, Matthew Puls, and Samantha Smithies

Energy use has drastically increased in local decades, far beyond what the planet can sustain (Millward-Hopkins et al., 2020). The energy requirements of well-being are unclear but it is clear that well-being is not unequivocally tied to energy consumption: there are countries achieving high social outcomes while consuming energy at rates far lower than other countries (Millward-Hopkins et al., 2020).

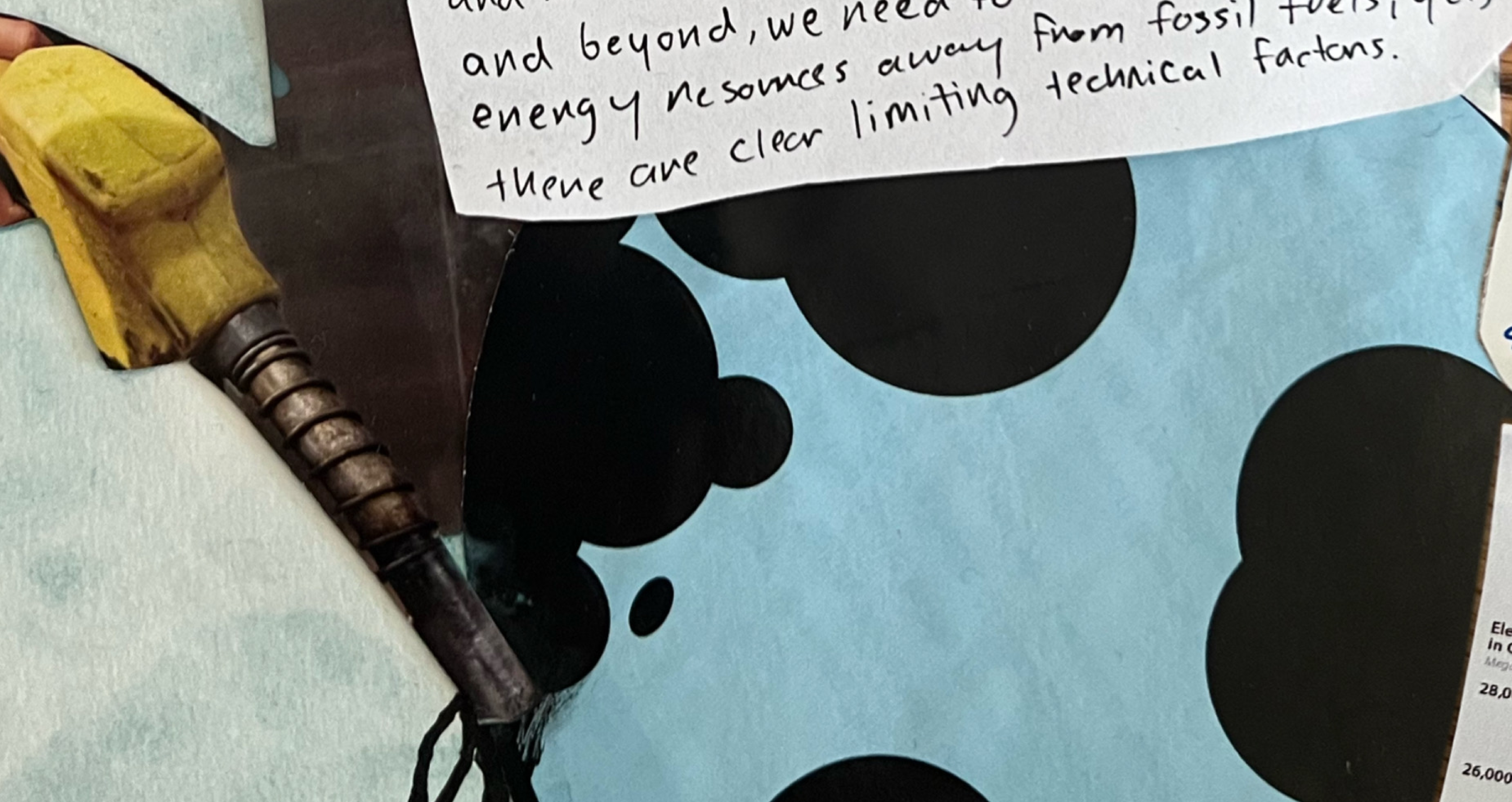


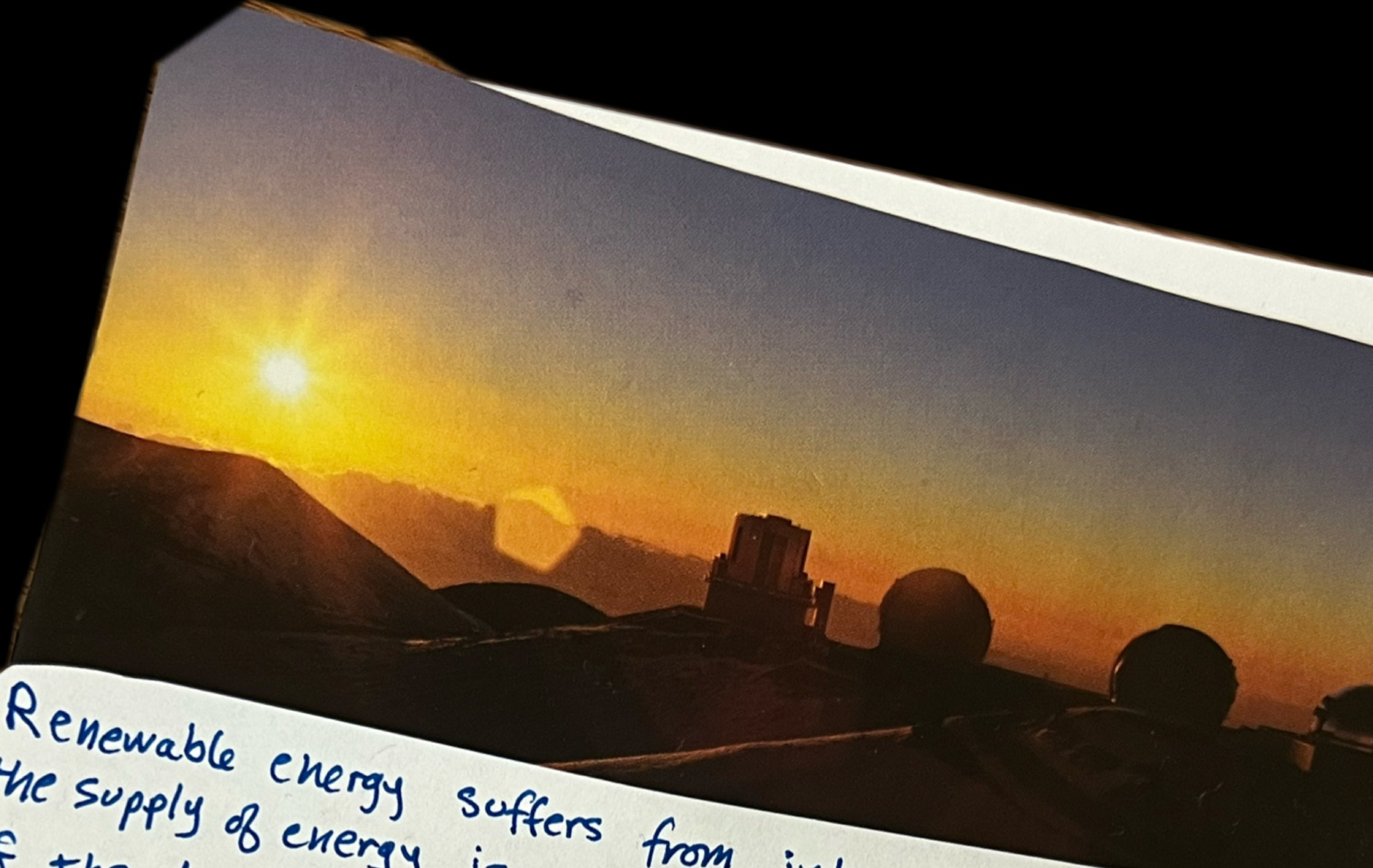
In addition to excess consumption, consumption patterns challenge challenge the energy system. The 9-5 workday established by mainstream capitalism produces peak demand after work hours—making it difficult for utilities to manage supply accurately, and posing additional challenges to increasing reliance on renewable energy (Bakke, 2017).



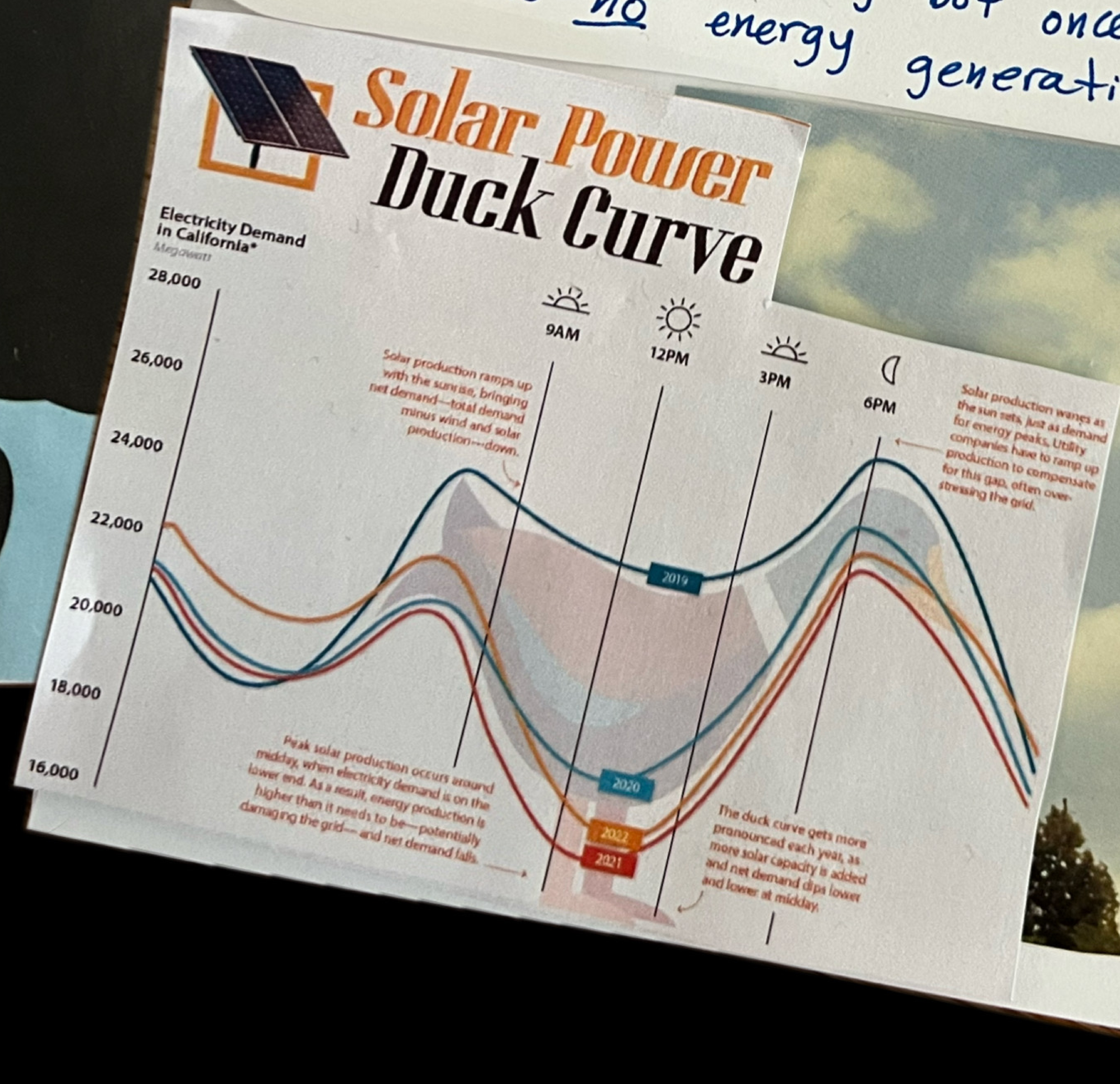
Though energy consumption is not evenly distributed around the globe, our cumulative excess generates global impacts that take place independent of where energy is generated or consumed. Shifting away from our fossil fuel dependence to renewable energy sources is essential to reducing greenhouse gas emissions from energy.

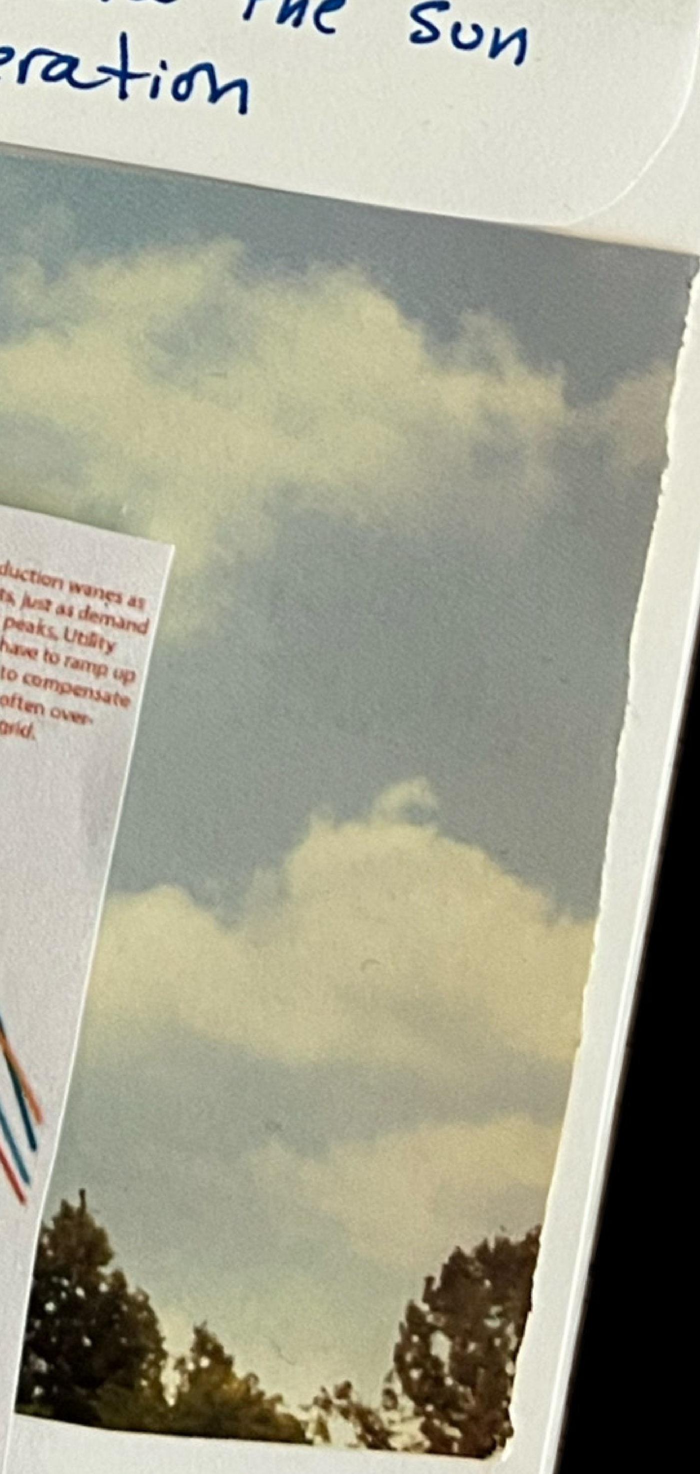
In California, the three largest sources of our energy supply are: natural gas (50%), solar (17%) and nuclear (8.5%) (Nyberg, 2021). In California and beyond, we need to further diversify our energy resources away from fossil fuels, yet, there are clear limiting technical factors.

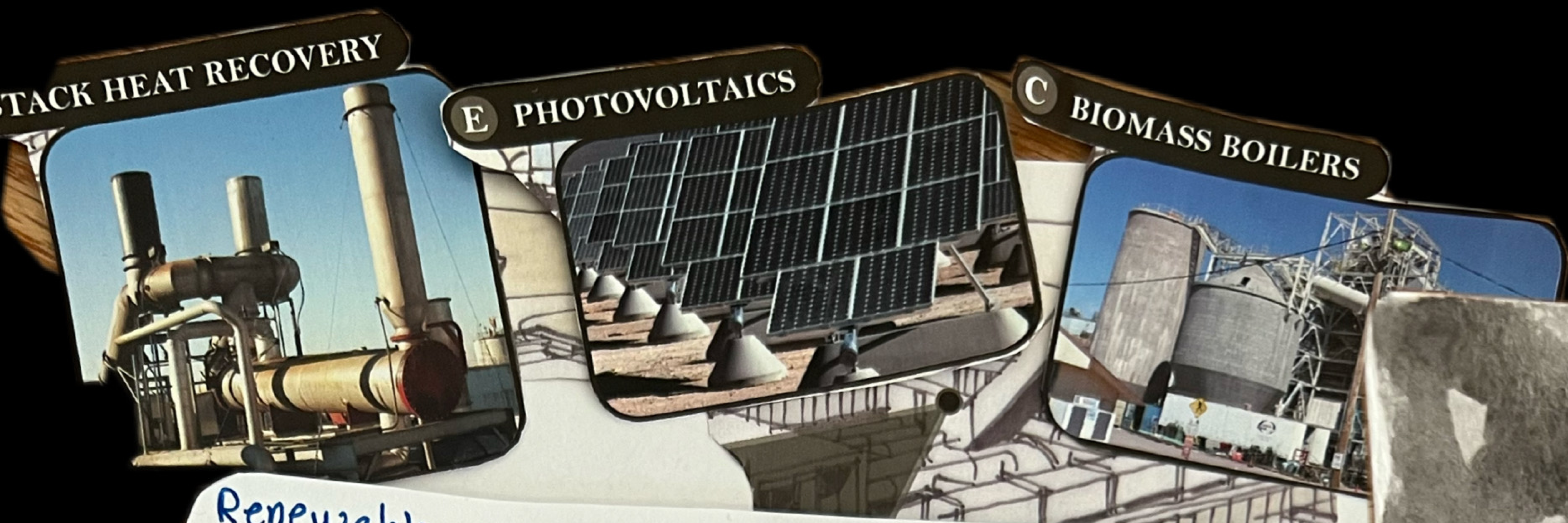




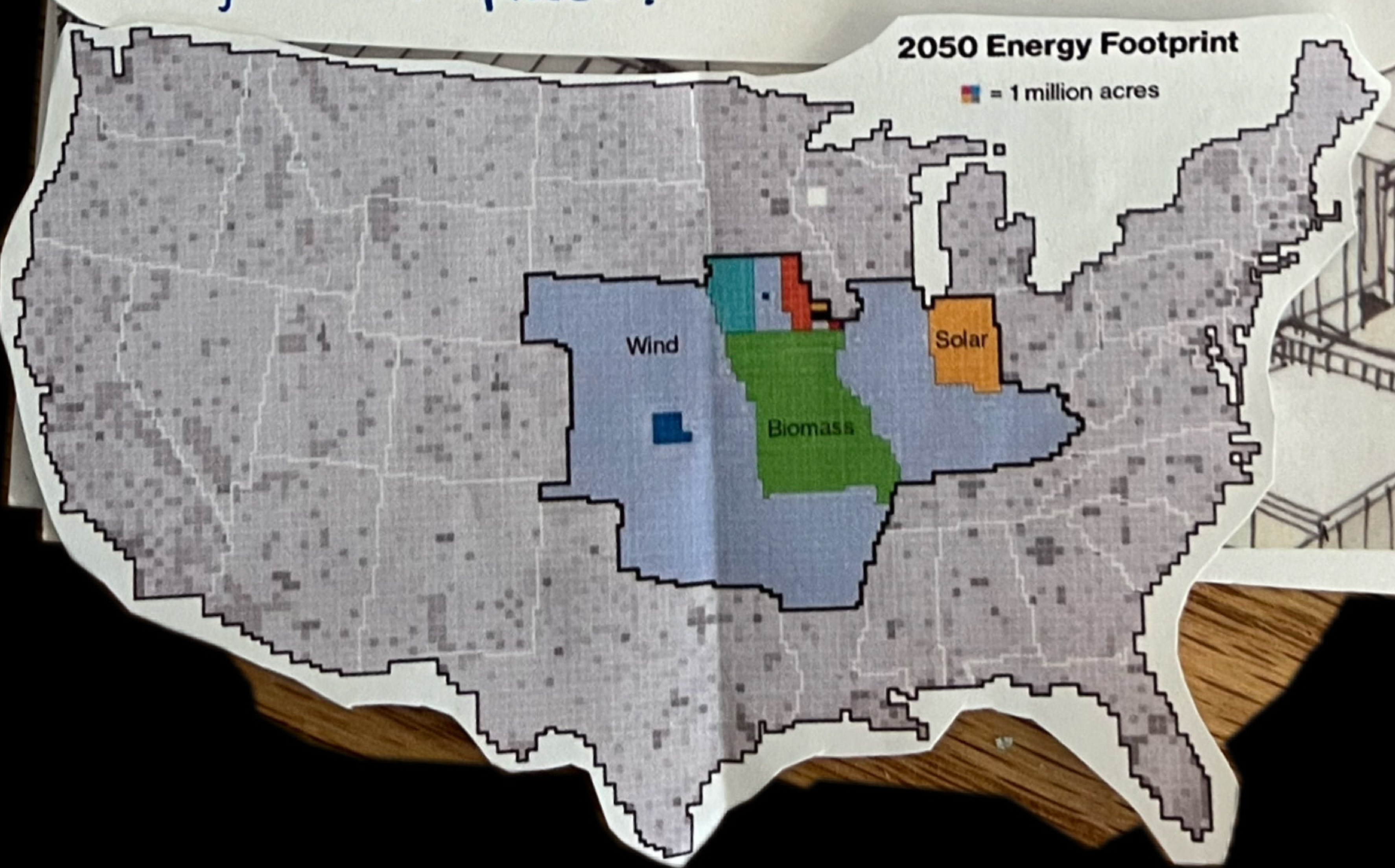
Renewable energy suffers from intermittency, meaning the supply of energy is not consistent throughout all hours of the day. For solar energy, this intermittency issue is known as the Duck Curve. The Duck Curve, coined and popularly used in California, describes how energy generation from solar is higher than needed during the day but once the sun sets, there is <u>no</u> energy generation







Renewable energy sources are not a perfect substitute for the fossil fuel energy we correntl**y** use. All energy sources, renewable and non-renewable, have different power densities. Power density is a measure of the amount of power output per unit area (Smil, 2016). The higher the power density, the lesser the land claim. Renewable energy sources, like wind, solar, and hydropower, have lower power densities than fossil fuels - this means that an energy transition will require significantly more land to generate equal amounts of energy as we do today. The next question is how to identify and determine which land areas are most suitable and what land uses we are willing to displace.

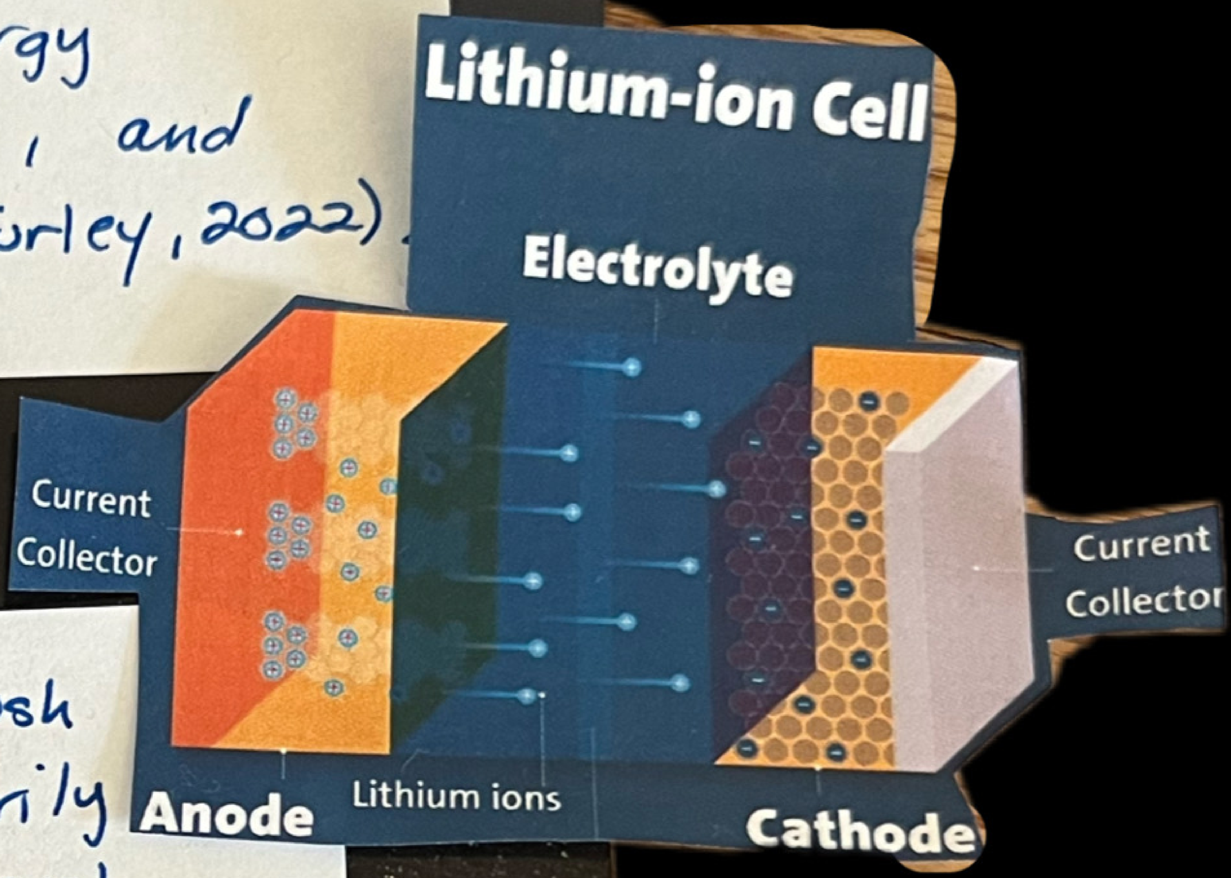


"Progress" is building clean energy infrastructure, such as solar, is not always an equally beneficial venture for all involved parties, especially when it comes to impact on "public lands". While we often consider the global impacts of energy use (climate change), energy infrastructure also has important localized implications.

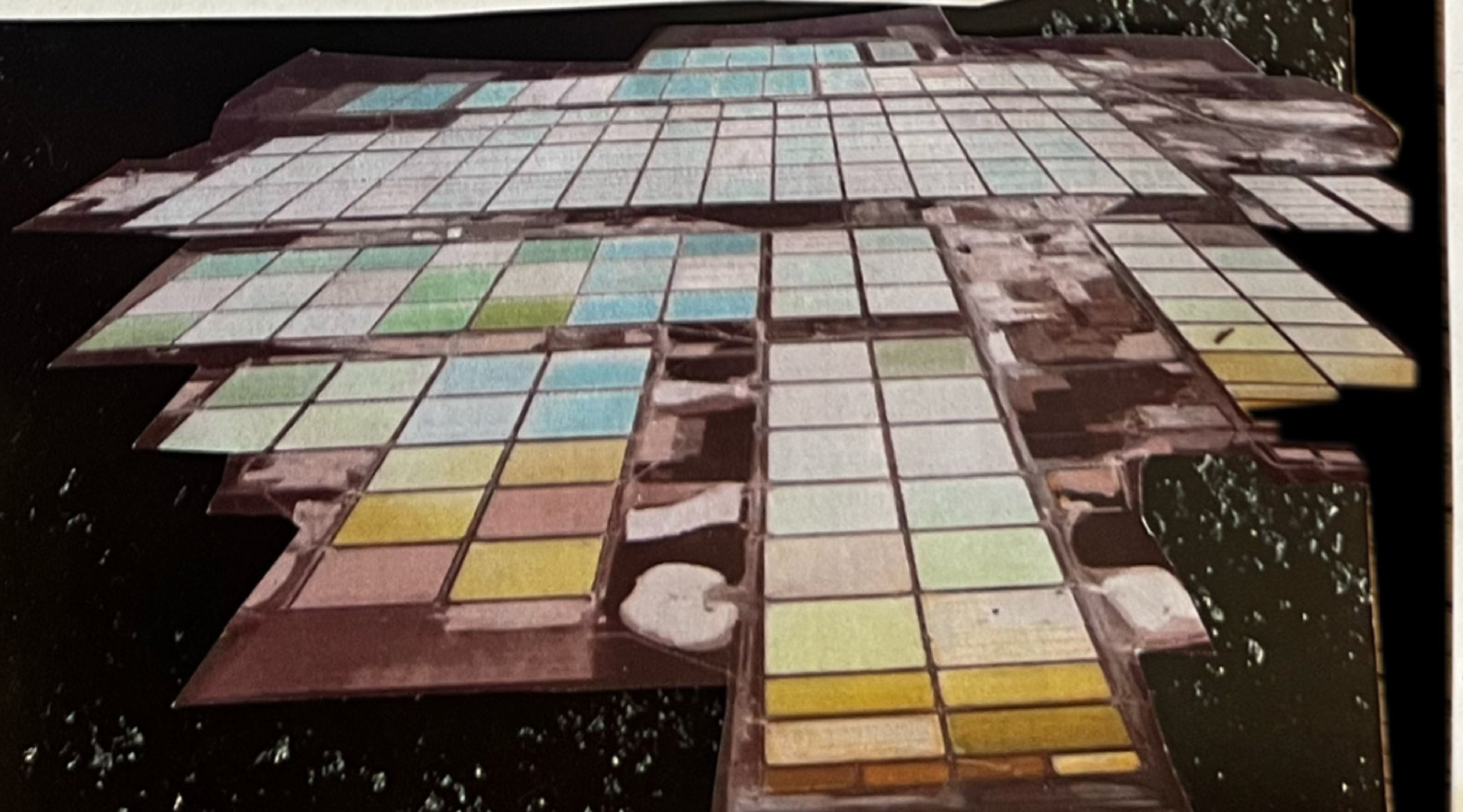
So-called public land within a state that is managed by the Bureau of Land Management (BLM) was often Acquired through indigenous land dispossession. Therefore land use for energy generation, green or not, is understandably a controversial and heavily opposed issue. Additionally, the impact upon local ecology and endagered wildlife has put many solar projects at a stand still. Mulvaney (2017) shows that dialogue, acess to information, community participation and the "incorporation of local knowledge" are key in mitigating opposition to Solar progress. Additionally, the use of previously disturbed or private land should be considered before public lands are the go-to.

Even if land use issues were resolved, the just transition is still hindered by the lack of energy storage. Intermittancy issues are exacerbated by the lack of variable energy storage and outdated battery technologies.

California illuminates the issues of energy storage. 95% of California's energy storage comes from pumped storage, and only 5% comes from batteries (Turley, 2022).



California has begun a massive push for improving battery technologies, primarily Lithium-ion batteries. However, large enough ore deposits are scarce and mainly found in Australia and South America, and there are large environmental and human risks associated with lithium mining. It requires a large amount of water and uses chemicals for extraction that radiate impact on humans, livestock, and wildlife.



It's not just an issue of energy generation and storage; the just transition will also require a transformation of our transmission infrastructure. Overhead electrical lines increase fire danger (Newsom, 2021). Low tech and high tech solutions can help mitigate wildfire risks, however, these come at high costs (Newsom, 2021). Grid hardening, which refers to installing more weather-resistant equipment, does not necessarily imply reconfiguring the grid. Utilities and governments must determine how to finance these critical infrastructure investments to increase resilience, yet the current structure of the grid may not be favorable to a just transition. Decisions about which strategies to pursue, such as monitoring technology or micro-grids (a smaller grid that can operate independent of the larger grid) will shape the structure of the energy grid of the future.

Whether public or private, utility companies, which up until 1978 had full control over energy generation, transmission, & distribution, wield immense power over the US energy system. Citizens' lack of awareness of the consolidation of power in investor-owned utilities and the financial and physical costs of electricity make it harder for people to organize for change, threatening the just transition (Bakke, 2017).

The financial resources of investor-owned utilities makes it exceptionally challenging to shift the power. Though there are more than 3000 electrical utility companies in America, more than 2/3rds of Americans pay their bill to 1 of 189 for-profit companies (Bakke, 2017). The infrastructure, lawyers, and capital that these entities control often dominate the discourse about the future of energy. The dividend-filled promises that they make to the shareholders are threatened by renewable energy (Kind, 2013). Investor-owned utilities are motivated to protect their profits more than they are motivated to further the just transition

These five issues are just the beginning of the hurdles in the way of achieving a just transition. Spillias (2020) reminds us, "that we are not trying to build a world full of solar panels and wind turbines for their own sake, "we are trying to build a world that is more prosperous, healthy and just." A truly just transition, not just one that allows us to maintain our status quo for longer, requires an enormous transformation of our social and technical systems. While the impacts are happening now and a solution is needed now, the pace of the just transition cannot be quickened carelessly. A just transition is not just about where we are going but also how we get there. The process of decision-making and tackling each of these issues in the pursuit of a just transition must be fair, transparent, and offer opportunities for engagement. A transition is happening but it will take intentional and consistent effort to make it 'just'.

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A just transition is a framework for shifting away from fossil fuels and toward renewable energy sources that simultaneously secures workers' and local community members' rights and livelihoods. The benefits of the energy and economic transition must be distributed widely and equitably, taking into account the uneven impacts of our current system on marginalized people and their local ecosystems. Our energy system is a socio-technical system: the social and technical infrastructure are deeply embedded and inextricably linked. Ensuring a just transition for California and beyond requires a nuanced, holistic plan. This means thinking about each stage–generation, transmission, distribution, and end use, from both social and technical perspectives. We begin to examine these issues, starting with:

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