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missing land-use planning efforts

Currently, about 29% of California's electricity comes from renewable sources (the largest shares are solar and wind), 36% from natural gas, and only 4% from coal, most of which is generated outside the state (California Energy Commission, 2017). To overcome this barrier, local jurisdictions will need to plan energy infrastructure from siting new renewable facilities to safeguarding transmission. This includes siting and support for microgrids and automatic adjustment of charging coordinated with grid load. Currently, there is no microgrid plan in place for any CA city or county. Nor is there a state plan, overview of local/regional efforts to meet this plan, or incentives for coordinated efforts.

2. The general plan presents an opportunity. Every city and county must have a general plan. Siting and planning new energy infrastructure will occur through this document. At the same time, there is no agency empowered to review how general plans include or comply with energy infrastructure mandates. The state needs to fund and empower an agency to review land-use plans for compliance with state goals. In addition, the state needs to support efforts for plan data infrastructure (eg. https://critical-data-analysis.org/general-plan-map/; demo:
https://brinkley.faculty.ucdavis.edu/home/research/planning/;
https://webmaps.arb.ca.gov/capmap/)

3. In short, no. Different regions will need to emphasize different technologies due to their specific geography and culture. For example, large-scale solar may work (landscape/climate-wise) for the Central Valley, but not the forested foothills.

4-12. The example solutions emphasize technological solutions; presupposing that the lack of R&D on technology is the problem. It seems like there are plenty of technologies that have not been broadly deployed (eg. district heating on university campuses- more below).

What is missing is a coordinated policy approach, planning data infrastructure, and planning oversight for the state mandates/plans that are produced.
District energy (DE) offers many of the benefits of heat pumps, at scale. Instead of every home and office operating an individual boiler, heat is produced centrally by water heated in a boiler and distributed through underground insulated pipes to heat exchangers at the point of use for hot water, ambient heat, and cooling (Bouffaron and Koch, 2014; Brinkley 2018). This network of underground pipes is a highly efficient way to heat and cool many buildings in a given locale from a central plant, such as a downtown district, college or hospital campus, airport, or military base. Fuel for the central boiler is highly versatile and can be coupled with a variety of large and small-scale heat sources such as geothermal and heat produced as a byproduct of industry

(Lund et al., 2014). Providing heating and cooling from a central plant requires less fuel and displaces the need to install separate space heating and cooling and hot water systems in each building. Further, district energy systems also allow for low-cost heat storage during times of overproduction from more volatile renewable energy sources, such as wind and solar (Lund, 2005; Connelly et al, 2014). Importantly, low-cost deployment of DE systems relies on higher density development to ensure that the cost of new pipes carrying heated or chilled water are cost and energy effective.

The United Nations estimates that transitioning to DE systems, combined with energy efficiency measures, could result in a 30â€“50% reduction in primary energy consumption, thereby reducing CO_2 emissions by 58% in the energy sector by 2050 and allowing global temperature rises to stay within 2â€“3â€¯Â°C (UNEP, 2018). Sweden presents one case example of implementing district energy on a large scale, as GHG emissions were reduced by 60% from the 1970s and the energy supply turned from importing 75% of the energy in the form of fossil fuel to greater reliance on locally produced energy, particularly biofuels from forest and agriculture byproducts (Summerton, 1992; Palm, 2006). As the case in Sweden shows, DE provides more than emissions reductions alone. University campuses also offer demonstrations (Han et al., 2021). Updates to Stanford Universityâ€™s DE system in 2014 cut campus GHG emissions by 68% and fossil fuel use by 65% (Lapin and Chelsey 2015).

DE benefits communities by reducing their operating costs and keeping more energy dollars local due to a decreased need to import fuel for heating and cooling. Environmental impacts from heating and cooling are significantly reduced because of the greatly improved efficiency of these systems and developing district energy and Combined Heat and Power (CHP) systems can help ease the transition of the power sector as older, polluting coal plants are shut down and removed from the grid. District cooling can cut peak electrical demand that typically occurs in the late afternoon â€“ reducing strain on the grid and avoiding expensive peak power costs (Environmental and Energy Study Institute, 2011). A transition to DE requires major infrastructure projects by connecting all of the buildings in a district to the central plant through underground pipes. Even though the aforementioned studies show the significant long term energy savings and environmental benefits â€“ and the fact that projects generate many good paying jobs â€“ the high upfront costs can discourage developers. Connecting CHP systems to the power grid can also be problematic. The state government can play an important role in encouraging investment in district energy/CHP systems through various financing and regulatory mechanisms (Environmental and Energy Study Institute, 2011).