Decarbonization Through Electrification:

A Trillion Dollars of New Transmission in the US by 2035

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The Policy Drivers:

- The US has made a commitment to reduce greenhouse gas emissions. One of the favored ways to decarbonize is to electrify energy uses that have traditionally been powered with fossil fuels. These uses include transportation, electricity production, industrial processes, and even the home uses such as water and space heating.
  - **Ambitious new targets**, including those to cut overall U.S. greenhouse gas emissions 50-52 percent by 2030 relative to 2005; 50 percent electric vehicle sales share by 2030; 100 percent carbon-free electricity by 2035; and a net-zero emissions economy by 2050.
  - **Passage of new laws such as the Inflation Reduction Act (IRA) and Bipartisan Infrastructure Law.** The IRA is the largest ever investment in clean energy and climate action ($783 Billion); it is projected to deliver 1 billion tons of greenhouse gas reductions by 2030.
  - The strongest passenger vehicle standards in US history to increase average fuel economy to 49 miles per gallon by 2026 and **triple electric vehicle sales** since January 2021.
  - **Cut methane emissions**, including through strengthened EPA regulations on oil and gas methane mitigation.
  - **Over $240 billion in new clean energy manufacturing investments** and projections that the U.S. is on track to **triple wind generation and increase solar generation seven- to eight-fold by 2030.**
  - The United States' Sustainability Plan includes goals to reduce the federal government's carbon footprint, including transitioning to 100% carbon-free electricity by 2030, 100% zero-emissions vehicles by 2035, net-zero emissions by 2050, and more.

The Transmission System

- The US electrical grid is the largest interconnected machine on Earth: ~275,000 miles of high-voltage transmission lines, 70,000 substations and 5.5 million miles of local distribution lines, linking thousands of generating plants to factories, homes and businesses. The National Academy of Engineering ranks it as the greatest engineering achievement of the 20th century.
- The DOE 2023 *National Transmission Needs Study* forecasts almost **60% increase in transmission capacity by 2035** to meet US goals for decarbonization.
  - This equates to **~165,000 miles of new transmission lines in 12 years**. At an average cost of $4 million per mile (the higher the voltage, the higher the cost), this equates to around **$650 billion**.
  - This will also require a proportional increase in substation capacity (new and expanded) that equates to another **$200-300 billion in the next 12 years**.

The Distribution System

- Of the ~5.5 million miles of distribution lines (medium voltage neighborhood lines) in the US, about 20% are underground.
- There is a major push to underground distribution for resiliency against storms, wildfires, etc., and for aesthetics.
- Undergrounding a mile of typical distribution costs about $3 million.
- PG&E alone has requested funding to underground 10,000 miles of distribution in the next several years @ $30 billion or more.
- Undergrounding usually involves both the public (franchise) and private rights-of-way and is highly disruptive to businesses as well as residences.

Renewable Generation

- The White House set out a target of 80% renewable energy generation by 2030 and 100% carbon-free electricity five years later. With 79% of total U.S. energy production still coming from fossil fuel sources as of last year, achieving this goal will require many billions of dollars in investments - and an enormous amount of land.
- This equates to around 580 GW of new renewable power by 2030. That's **580,000 MW**. On average, wind needs 2 acres/MW; solar uses 5 acres/MW. Assume 50/50 between wind and solar, and you need around 580,000 acres for wind and 1.5 million acres for solar – **over 2 million acres of land that could come into play before 2030.**

Other Impacts…

- Electric Vehicles: The U.S. Department of Energy's National Renewable Energy Laboratory estimates the country will need **28 million charging ports by 2030** just to refuel the 33 million light-duty electrics that could be on the road by then.
- Green Hydrogen: Green hydrogen is made by splitting water in an electrolyzer- a machine that uses green electricity to make the hydrogen.
- Energy storage: Many experts believe the US will need about 100 GW (100,000 MW) of energy storage by 2030 to make solar and wind reliable 24/7. Every MW of battery energy storage fills a shipping container.

Specific Cases…

- Clearly, the so-called “energy transition” has huge implications for appraisals, eminent domain cases, etc., etc. Interesting cases:
  - Utilities can’t condemn Native American tribal property – they must negotiate. And reservation land is surprisingly often in the middle of areas with exceptional wind and solar (a bit of irony?)
  - Landowners are increasingly convinced that their land MUST be much more valuable than utility appraisers think it is, because it is “the best” land for solar and wind. This will require new sophistication to understand what **really** constitutes good solar or wind land. Emily is going to share a real, recent case in which she represented the utility party with great skill.

Case Study… AVEK & High Desert Water Bank

Case Study… Highest & Best Use

- Legally Permissible
- Physically Possible
- Financially Feasible
- Maximally Productive

Appraisal Institute, *The Dictionary of Real Estate Appraisal*; CACI No. 3502

Case Study… Issues

- High Demand for Renewable Energy
- Is it feasible though?
  - Available capacity
  - Solar friendly jurisdiction
  - Solar insolation
  - Site topography
  - Site accessibility
  - Proximity to transmission lines

Takeaways

- Energy Transition Underway
- Consider Feasibility
- Team Approach
- Coordinate/Communicate

Questions?