Candor, Climate, and the Energy Transition

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A very fresh example

NOW THEREFORE, I, GAVIN NEWSOM, Governor of the State of California by virtue of the power and authority vested in me by the Constitution and the statutes of the State of California, do hereby issue the following Order to pursue actions necessary to combat the climate crisis.

IT IS HEREBY ORDERED THAT:

1. It shall be a goal of the State that 100 percent of in-state sales of new passenger cars and trucks will be zero-emission by 2035. It shall be a further goal of the State that 100 percent of medium- and heavy-duty vehicles in the State be zero-emission by 2045 for all operations where feasible and by 2035 for drayage trucks. It shall be further a goal of the State to transition to 100 percent zero-emission off-road vehicles and equipment by 2035 where feasible.

California Governor Executive Order 79-20, Sept. 23, 2020

Public commentary I

EPA Administrator Andrew Wheeler doubts California can reach its goal of only zero-emission cars and trucks on the road by 2035.

In an interview this afternoon for the Concordia Summit, Wheeler said he doesn't think the public is ready for the Golden State proposal aimed to help combat climate change. He suggested the plan put forth yesterday by California Gov. Gavin Newsom (D) may be intended to distract from the devastating wildfires that have ravaged the state.

"I think it's more aspirational at this point, and probably more political, probably as a reaction to try to turn the attention away from their mismanagement of the forest fires in California," Wheeler said. "Electric vehicles are great. It's good to see more of them. But I just don't think that even the state of California can get to 100% by 2035."

The EPA administrator said the agency's analysis of the prior administration's fuel economy standards found the public wasn't embracing electric vehicles to a great extent. EPA has replaced those Obama-era standards, weakening limits on greenhouse gas emissions for automobiles.

"I don't think any level of government, whether it be a state or the federal government, should dictate a particular technology to the public," Wheeler said. "People are free to buy an electric vehicle if they want. People are free to buy an internal combustion engine vehicle if they want."

Wheeler also questioned whether China would stick to its pledge to end its carbon emissions by 2060. Yesterday the superpower announced its promise, putting it on a more ambitious climate path than the United States currently.

"They've made a lot of proclamations in the past that haven't panned out," Wheeler said, touting U.S. reductions in carbon emissions. "They've talked about how they're going to expand to renewables and have all this investment in renewables. They do invest quite a bit in renewables, but it's dwarfed by their fossil fuel consumption."

Wheeler added, "We should take that not just with a large grain of salt, but with a shaker of salt."

"Wheeler calls California's ZEV goal 'political,'" E&E News, Sept. 24, 2020

Public commentary 2

Gov. Gavin Newsom flatly declared Wednesday that "In the next 15 years we will eliminate in the state of California the sales of internal combustion engines."

It was the latest example of Newsom's fondness for headline-grabbing pronouncements of "big hairy, audacious goals."

The classic example was his flat campaign declaration that he would solve California's chronic housing shortage by building 3.5 million new homes.

That was impossible, as anyone familiar with housing issues could attest, and after his election, Newsom backed off, calling it an "aspirational" goal. Actually, housing production has declined during his governorship.

The governor's declaration that by 2035 new car buyers in California must buy only "zero emission vehicles" (ZEVs) seems to be in the mold of his housing promise. In fact, **his executive order** does not command that it happen, but rather says "it shall be a goal of the state that 100 percent of in-state sales of new passenger cars and trucks will be zero-emission by 2035" and directs the Air Resources Board to figure out how to do it "consistently with technological feasibility and cost-effectiveness."

Public commentary 3

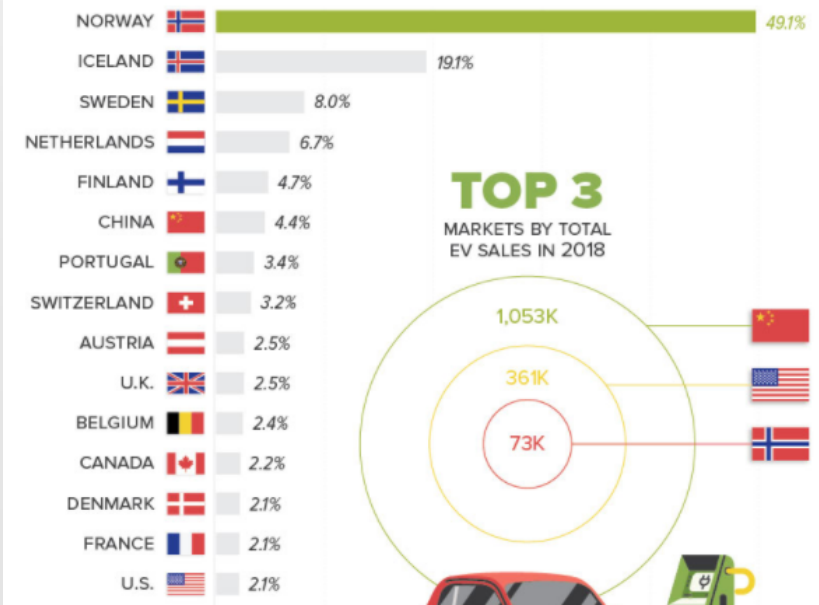
California, which is seen as the leader in electric vehicle adoption in the US, is still nowhere near its goal to have 5 million zero-emission vehicles on the road by the end of the next decade.

The US is already lagging behind many other countries when it comes to electric vehicle adoption.

In terms of volume, the US is buying a lot of EVs because it's such a large market, but the number is nothing compared to the amount of gas-powered vehicles being added on US roads each year.

EV sales are obviously behind smaller nations who have taken clear leadership in EV adoption, like Norway or Iceland, but it's also behind some bigger markets like China, the UK, and Canada.

According to registration data, the US ranks 15th in electric vehicles as a percentage of total vehicle sales:



Elektrek, August 18, 2019

Consequences and citizenship

- Gasoline service stations already shut out of long-term loans? (*San Jose Mercury, CalMatters*)
- Experts, experts everywhere
- What is a citizen to make of the announcement, the criticisms from both flanks, and the track records?
- Should we expect Governor Newsom to detail what is required and from whom, and to acknowledge the challenges and risks of his own pronouncement?

Today's presentation

- **What is the energy transition?**
  - *It is about decarbonization*—deep *decarbonization*
  - *But it is about* more *than decarbonization. What are the other features?*
  - *Developing a working definition of the transition*
- **What is entailed by a deep decarbonization goal?**
  - *The context*
  - *The implicit project*
- **Understanding some leading decarbonization goals**
- **The role of candor in energy policy discussions**

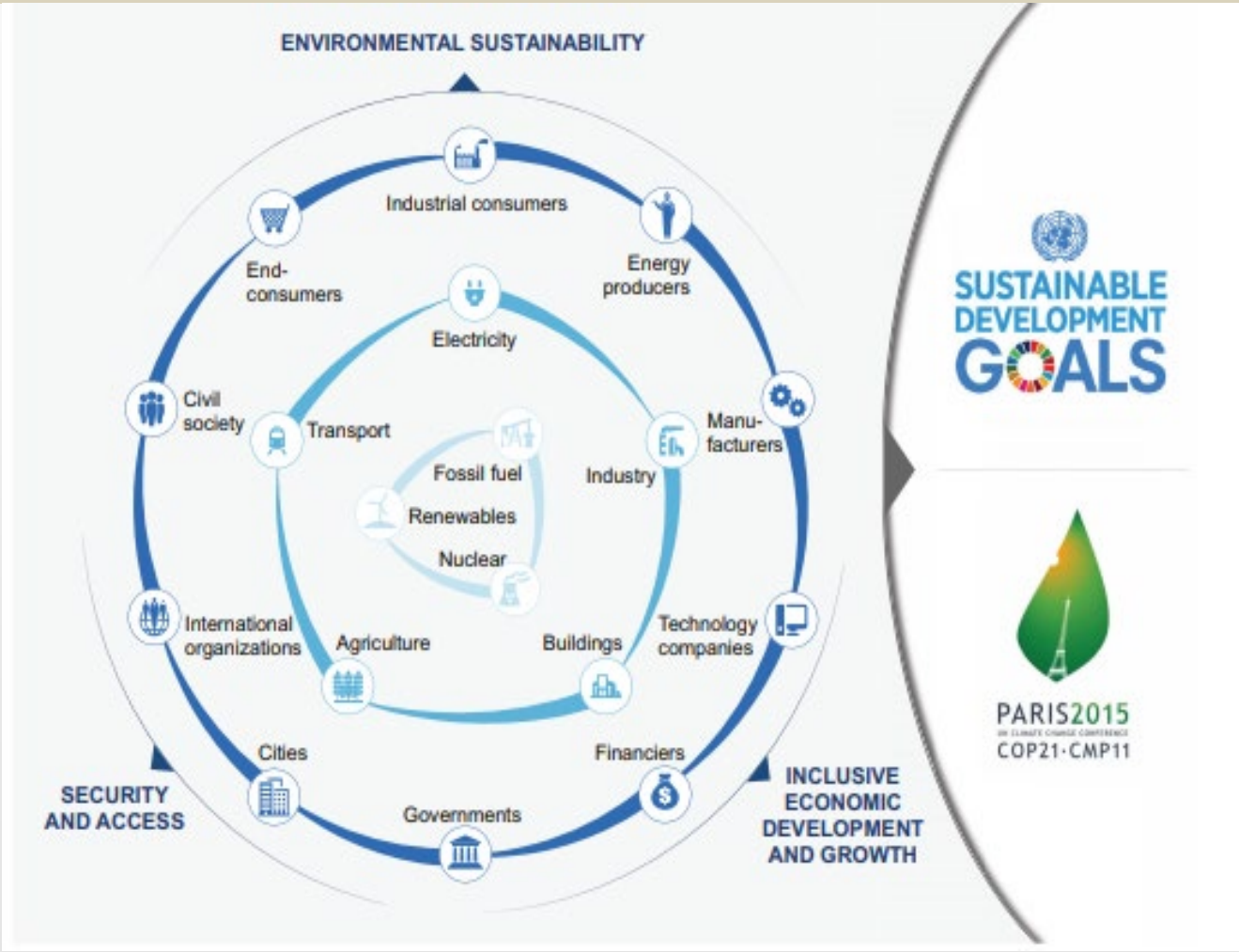
Energy transition

- **"[W]hile energy transition has become a pervasive theme all around world, disagreement rages, both within countries, and among them, on the nature of the transition: how it unfolds, how long it takes, and who pays."** (Daniel Yergin, 2020)

- Common hallmarks are
  - *the decarbonization of energy sources*
  - *the electrification of energy uses*

- Paris Agreement: net zero emissions by midcentury (U.N. Doc. FCCC/CP/2015/10/Add.1 (Jan. 29, 2016))

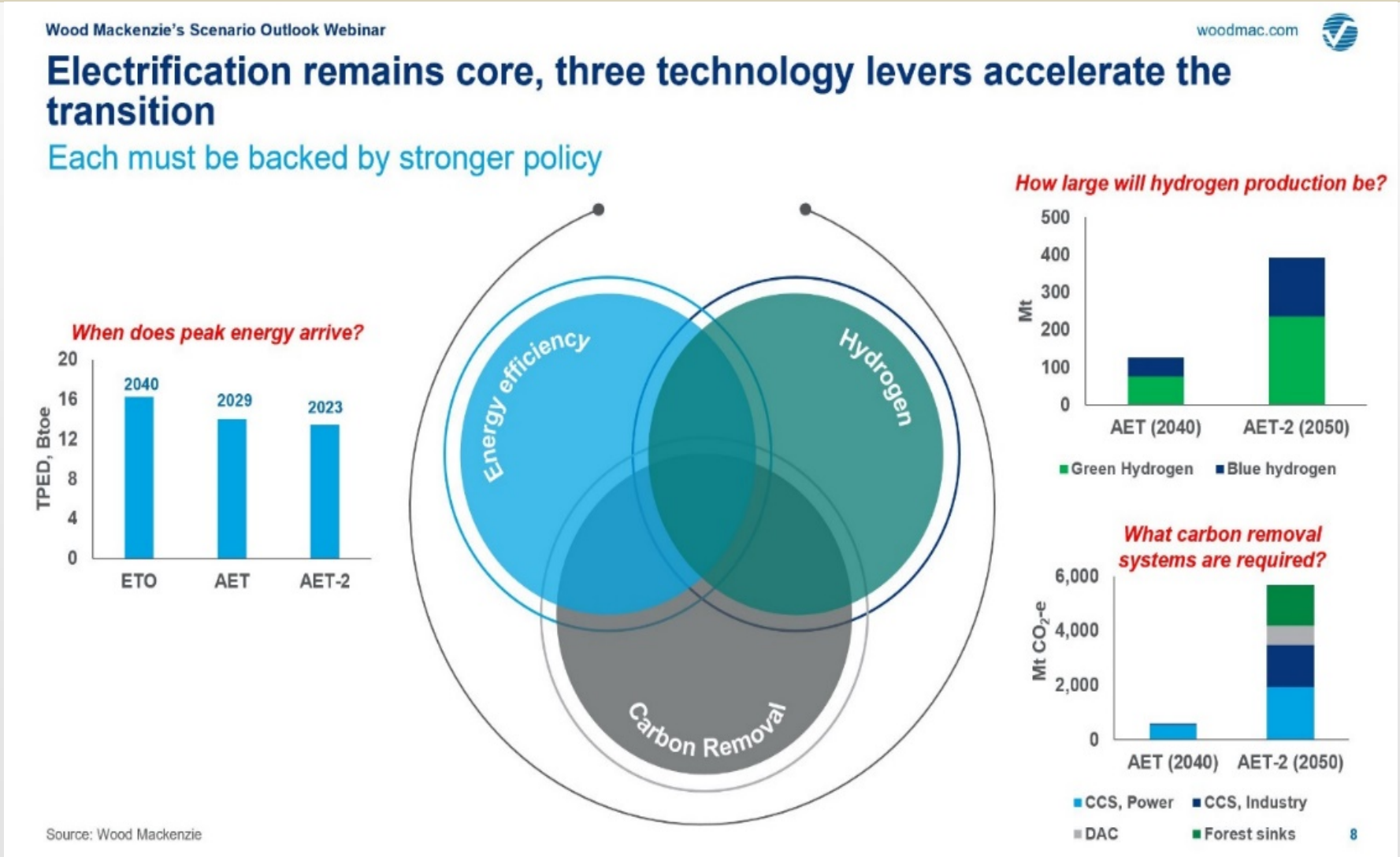
Energy transition



Energy transition

- **Or, pursue what can be measured:**
  - Decarbonization
  - Electrification
  - Energy intensity
    (amount of energy needed for increment of GDP or other measure of welfare)
  - Distribution of energy use to developing countries

Energy transition



Energy transition

- Sustainability, circular economy
- Economic development
- Population growth (world: 7.8bn in 2020)
- Access to basic energy needs (world: 860mm no power, 2.6bn no clean cooking fuel)
- Specifics in flux
  - *Natural gas—remember 2016?*
  - *The (re-)emergence of green and blue hydrogen*

Energy transition: a working definition

1. **Renewable generation:** onshore/offshore wind, PV/CSP solar, geothermal, hydroelectric, biofuels	5. **Efficiency in infrastructure:** efficiency in building design, construction, operation and life-cycle costs
2. **Storage of electricity and heat:** pumped water storage, lithium-ion and next generation batteries, hydrogen or ammonia fuel cells, thermal storage	6. **Enhancements to grid and distributed resources:** accommodate renewable and storage assets in baseload; behind the meter solutions, demand reduction incentives
3. **Carbon consciousness for fuels in transition:** reducing emissions in production and transmission, enhanced efficiencies, carbon capture and storage (CCS) for blue hydrogen, ongoing non-fuel uses of petroleum	7. **Greening of transportation, industrial and public end uses:** overhaul of entire infrastructure and end uses—vehicles on land, sea and air, fueling/charging stations, renewable solutions for hard to electrify sectors (steel, cement, petrochemicals)
4. **Hydrogen from renewables:** green hydrogen through electrolysis, buildout of hydrogen infrastructure and end uses	8. **Enhanced energy technology:** R&D on generation, storage, use; advanced nuclear, bioenergy, direct air capture, solar radiation management, geothermal…

and …

9. Equity in the energy transition

a. Affordability, availability and access
b. Sustainability
c. Security and diversity of supply (in a pandemical world)
d. Environmental justice
e. Distributional equity
f. Educational equity
g. Adjustments from the fossil economy and workforce

Decarbonization and transition

- View decarbonization goals through the prism of your understanding of the energy transition
- What about the components and equity standards of the transition?

Now for the decarbonization goals

- First, where are we today?
- Everyone needs to start with the same data
- Rarely referenced, so citizen beware!
- **The context**
  - Total energy use or electrical generation
  - Sources—fossil (oil, gas, coal), nuclear, renewable
  - Types—combustion, heat, electricity
  - Uses—residential, transportation, commercial, industrial, public
  - Current and anticipated changes in the rates

The U.S. electric context today

- Total U.S. electric generation
  - EIA 4178 TWh, BP 4401 TWh, IEA 4194 TWh: close enough
  - Slightly lower in 2020 compared to 2019, chalk it up to COVID?
- Mix of electricity source fuels **62-20-17.5%**
  - Gas 38 and rising, coal 24 and falling
  - Nuclear 20 and steady
  - Hydro 7 and steady, wind 7 and rising (onshore), solar 1.8 and rising fast
- 64,000 wind turbines, adding 3000+/year per AWEA and USGS (3581 in recent year)
- 1.5 million solar roofs, with 2020 shaping up as slight improvement over last year (3 GW v 2.8 GW)

What is the destination "end zone"?

- What year? 2030, 2035, 2040, 2050…
- What population assumption?
- What rate of growth in generation demand per capita?
  - Upward indicators: population, electrification—every missing combustion engine, every retired gas heating system means a greater power draw
  - Downward indicators: greater efficiency of electric end use (less heat loss, more energy directed at locomotion), greater productivity per unit of GDP or social welfare
- How does a goal propose to move from today's context to this end zone, with all or nearly all decarbonized energy sources?

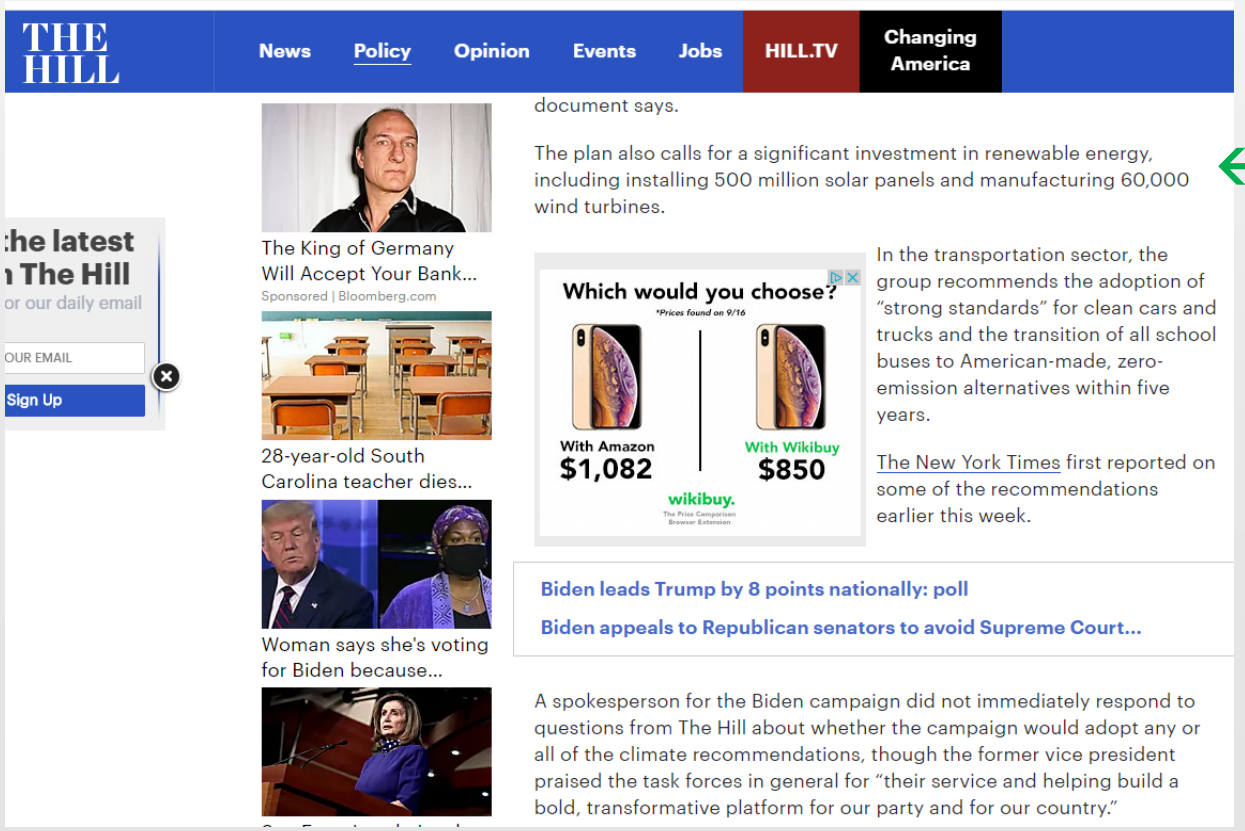
Biden(-Sanders) goals

- 100% electric new buildings 2030
- 100% US net zero electricity 2035
- 100% US net zero energy 2050

- “Within five years, we will install 500 million solar panels, including eight million solar roofs and community solar energy systems, and 60,000 made-in-America wind turbines.” (Unity plan of campaign staffs)
- No description of destination end zones

The press coverage

- *Joe Biden and Bernie Sanders Deepen Their Cooperation*, N.Y. TIMES, July 10, 2020 ("goal from the climate change task force to eliminate carbon emissions from power plants by 2035"; no reference to numbers of turbines or panels)



← **Entire coverage of numerical goal**

← **Not binding precedent**

Citizenship in wake of press coverage

- Do we have enough information to understand the goal?
- What more would we want to know?
- What can ordinary informed citizens understand and what must they take on faith from experts? Which experts? What if the experts disagree? *(They often do.)*

- Often, the necessary information emerges from those marketplaces of ideas known as… *the comments sections and blogs.*

Understanding the Biden(-Sanders) goals

- 60,000… 8 million… 500 million…
- For any of these, **is that a lot?**
  How much more than today's total or current rate?
- Incremental or cumulative? *(vox clamantis in deserto)*
- How would the federal government make it so?
  - *Visualize how one renewable project is launched, how one fossil is retired*
  - *Now visualize the scale contemplated by the goal*
- If these goals are achieved for 2021-2025, how close will that bring us to attaining the 100% goals for 2035 and 2050?

Understanding the Biden(-Sanders) goals

- 60,000 U.S. wind turbines 2021-2025?
  - Recall ~60,000 total today, and 3581 turbines installed in recent year
  - So maybe 5000/year 2021, scaling to 20,000/year in 2025?
  - Manufacturing capacity in U.S., post-COVID?
  - Have the best sites been taken?

- 8 million new roofs and 500 million solar panels 2021-2025?
  - A panel is typically 39" x 65", so visualize ~20 on *residential* roof
  - Recall 1.5 million roofs total today
  - So maybe 500,000/year roofs 2021, scaling into millions/year by 2025?
  - Material, infrastructure, interconnection needs
  - Locations and distributed generation, site entitlement
  - In both cases, federal role—tax incentives, transmission, FERC?

Understanding the Biden goals

- Not necessarily challenging the practicalities of achieving the goals
- But the campaign materials and even the subject matter press do not help the citizen understand
- Must clap for the numbers, and take the project on faith, or work through the details
- Difficult for a citizen to have an intelligent understanding of the goals, the contexts, and the implicit projects

The broader Biden platform

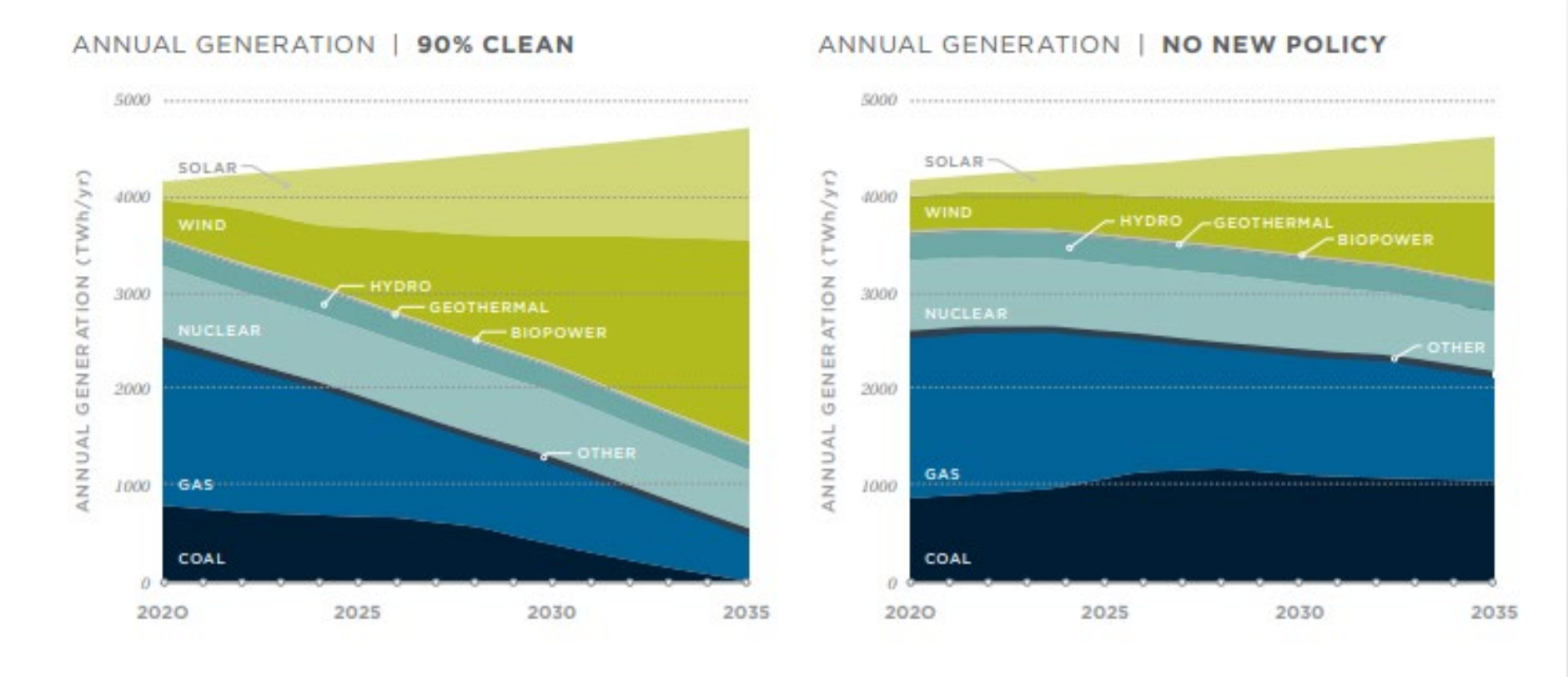
- Beyond renewables
  - *Hydraulic fracturing in the transition; Pennsylvania*
  - *Nuclear and CCS (fossil) in the mix*
- Carbon tax or cap and trade, other revenue sources mentioned?

International Energy Agency (IEA)

- Net zero total energy by "mid-century"
- Focus on R&D to 2050 (faster, unprecedented) or 2070 (sustainable) rather than on deployment commitments
- 40+ technologies needed, only 6 of which are on track. Focuses:
  - *Energy efficiency (smart buildings, grids)*
  - *Renewable generation for baseload*
  - *Storage of energy and heat*
  - *Hard to electrify sectors*
- Extend lives of large hydroelectric and nuclear, streamline permitting and land use process

Goldman 2035 Report

- 90% net zero U.S. electricity by 2035
- Remaining 10% fossil, for hard to electrify sectors



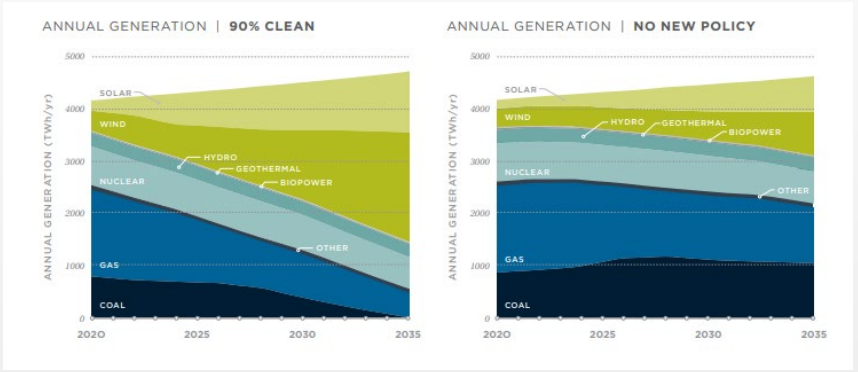
Goldman 2035 Report

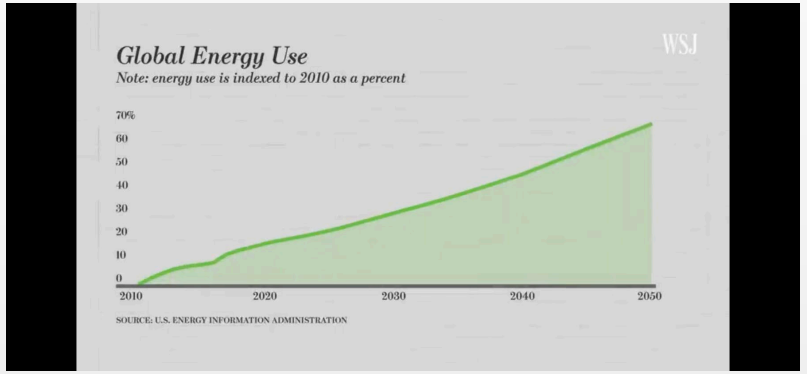
- A literature survey!
  How this goal and study differ from others, and why they differ
- Modeling how renewable installation rates can double in 2020s and triple in 2030s—maybe faster than that
- Cost factors behind the 90% goal—and think tanks still propose 100%
- Report addresses land use, transmission, FERC
- Though short-term power costs are higher, they are projected to be much lower over time, through elimination of fossil subsidies and internalizing health and occupational benefits of renewables
- Some good standards for candor here

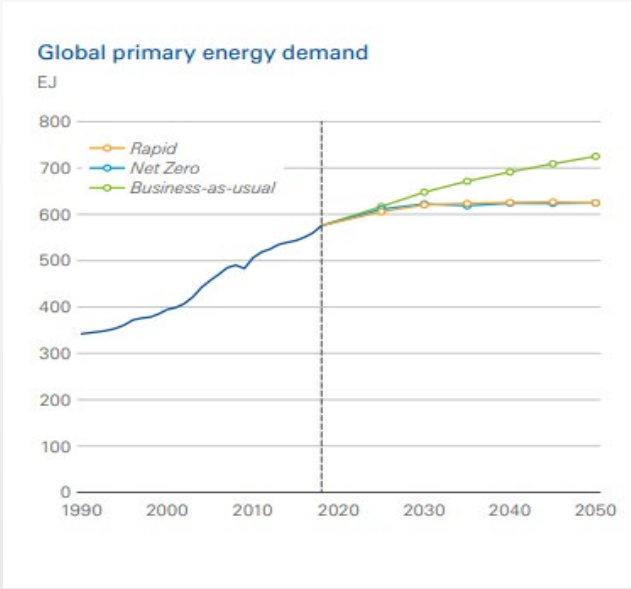
Atmosphere/Energy Program

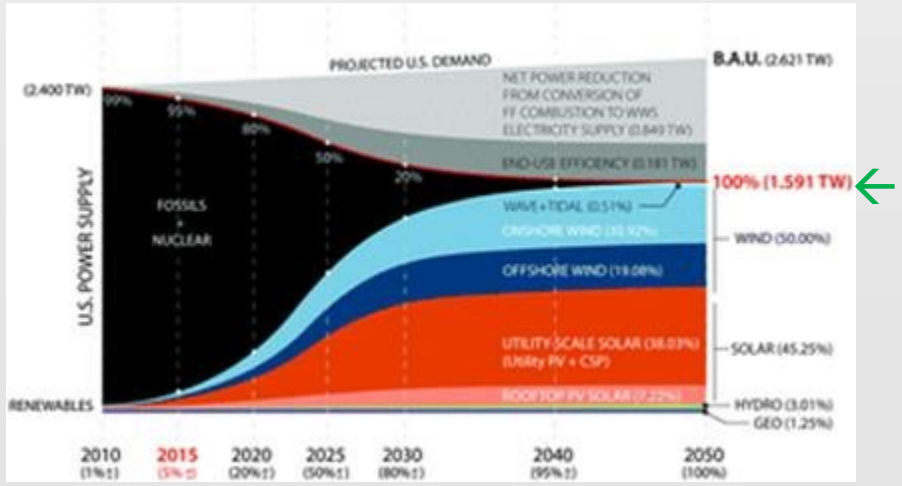
- 80-85% net zero U.S. total energy by 2030, 100% by 2050
- Multi-pronged progress on many fronts: acceleration of wind (offshore/onshore), water and solar (WWS) generation; expansion of electric and thermal energy storage; grid and infrastructure overhauls and improvements
- Extensive and creative use of thermal storage systems.
  But is the United States like Denmark?
- Challenges of electricity or hydrogen for hard to electrify sectors.
  Example of aviation.

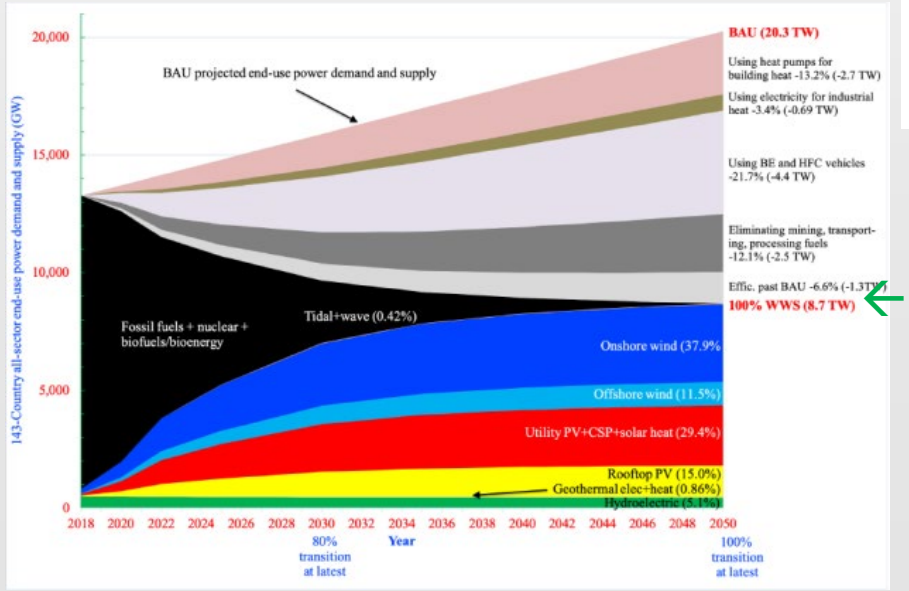
Atmosphere/Energy Program











Columbia University

- Center for Global Energy Policy: advocate R&D for offshore wind, CCS, bioenergy, advanced nuclear—areas with most need and perhaps most promise?
- Center with Global CCS Institute: advocacy of CCS and blue hydrogen
- Similar calls from nuclear, renewable, and government sources for green hydrogen
- Tax and other incentives, legal clarifications, liability cutoffs
- The issue of project-on-project risk

MIT

- Research, plus the role of "firm resources" in the transition
  - *Fuel-saving resources* (solar, wind, run-of-river hydro)
  - *Fast-burst resources* (batteries, thermal storage, demand incentives)
  - *Firm resources* (gas (especially with CCS), nuclear, reservoir hydro, biogas/mass)
- Speaks to affordability and access—up to 62 percent less expensive to achieve net zero using firm resources
- Acknowledges higher costs and uncertainties of generation, storage
- How can a research program be candid and accountable? How long does one back a technology that has not yet succeeded?

Back to candor

- It is not easy for the citizen to understand the decarbonization goals
- The proponents do not tend to volunteer the context or the implicit project, let alone how a project would be paid for
- The popular press and social media are not motivated to do so; it is enough to indicate who is on the "right" side of an issue
- Others in the process, even "fact-checkers," have their own agendas
- Example of Green New Deal and tweets from the left and the right
- So where can we find the necessary candor?
  Or is candor an unrealistic goal?

Candor flows more easily in opposition

The New York Times https://nyti.ms/30Rq5b1

'The Coal Industry Is Back,' Trump Proclaimed. It Wasn't.

The demise of coal-fired power plants in Arizona and Kentucky shows how the president, despite promises to restore jobs, failed to counter the forces decimating the industry.

By Eric Lipton

Oct. 5, 2020 Updated 11:47 a.m. ET

PAGE, Ariz. — For decades, waves of electricity poured from this behemoth of a power plant on the high desert plateau of the Navajo reservation in northwestern Arizona, lighting up hundreds of thousands of homes from Phoenix to Las Vegas as it burned 240 rail cars' worth of coal a day.

But as the day shift ended here at the Navajo Generating Station one evening early this year, all but a half-dozen spaces in the employee parking lot — a stretch of asphalt larger than a football field — were empty.

It was a similar scene at the nearby Kayenta coal mine, which fueled the plant. Dozens of the giant earth-moving machines that for decades ripped apart the hillside sat parked in long rows, motionless. Not a single coal miner was in sight, just a big, black Chihuahuan raven sitting atop a light post.

Saving these two complexes was at the heart of an intense three-year effort by the Trump administration to stabilize the coal industry and

Do we risk chilling the vibe?

Michelle T. Davies (née Thomas) • 1st
Partner and International Head of Clean Energy and Sustainability at Eversheds Sutherland
1w • Edited •

Pretty incredible to see the announcement today. It is great that the Government has ambitious targets for wind power in the UK. However a key challenge remains which is the route to market. I dont want to be a doom monger on such an important day but this really could be a road block to any outcome the Government hopes to achieve. In simple terms, for these projects to attract the lowest cost of capital, a necessity for keeping prices low for consumers, projects need to secure long term contracts for the sale of the power. This way, funders have certainty over cashflows to repay their investments, which in turn reduces risks and helps keep the cost of funding down, which again reduces the price to the consumer.

Is candor an excuse for timidity?

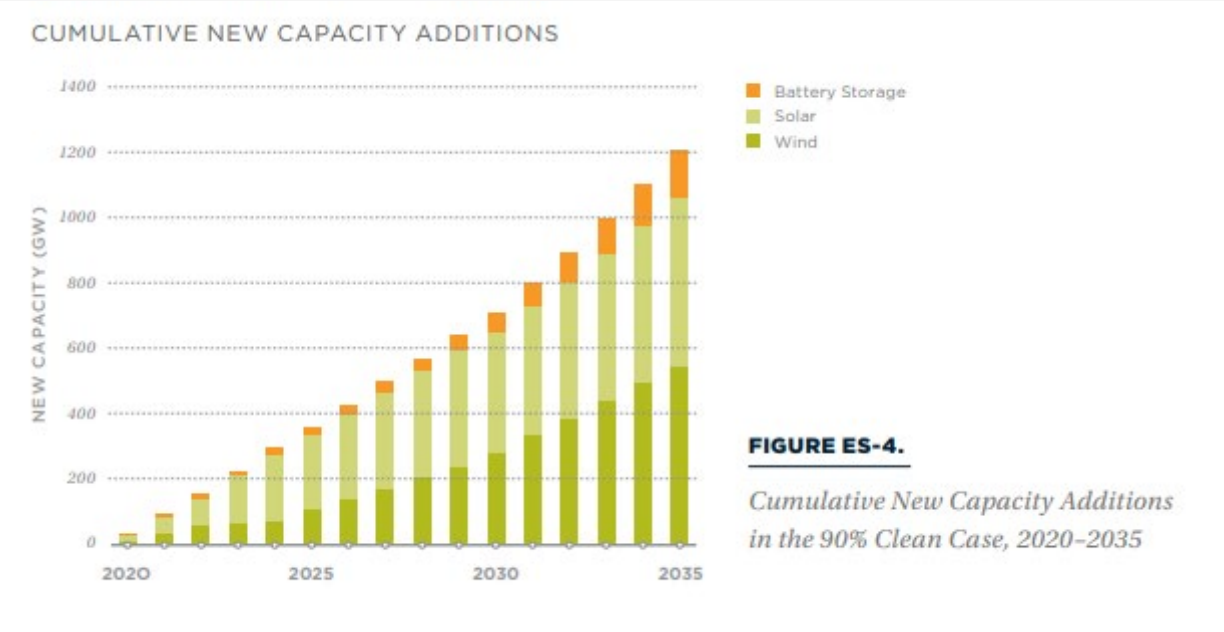
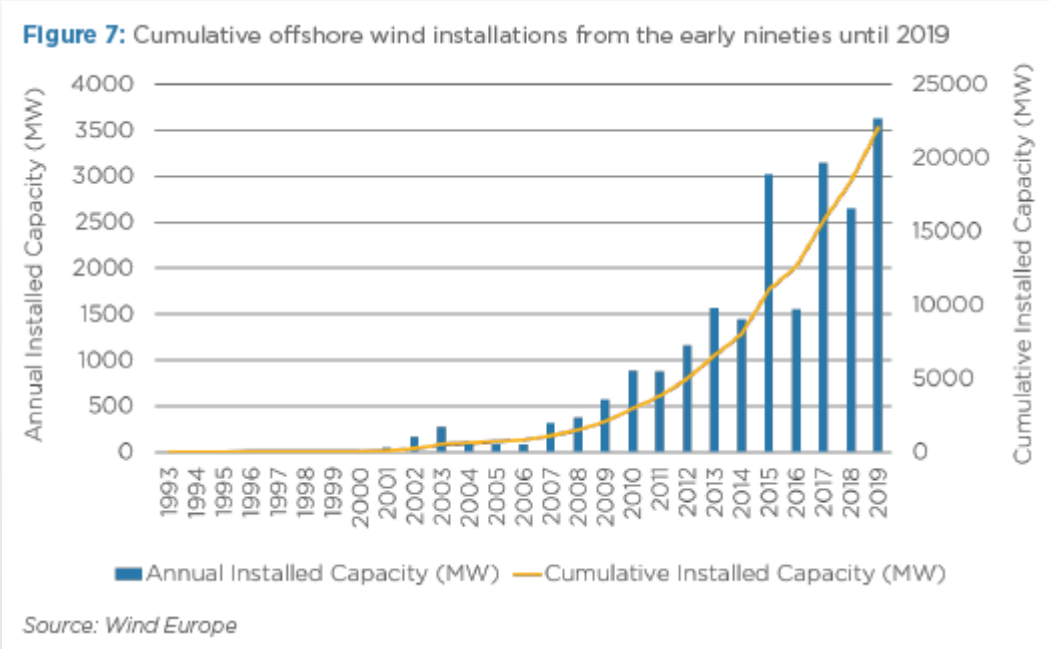


FIGURE ES-4.

Cumulative New Capacity Additions in the 90% Clean Case, 2020–2035



Source: Wind Europe

Are decarbonization goals unprecedented?

- World War II aircraft production
- Manhattan Project
- Interstate Highway Project
- BART
- NASA Apollo Project
- COVID-19

- The demands of climate change are unprecedented, not surprising that the remedies are unprecedented too

Can the system supply candor?

- We deserve candor
- Deserving has nothing to do with getting
- Political drivers will continue to drive the electoral process
- Aspirational goals have real consequences—diverting resources has costs
- Academic professionals can help:
  literature surveys, detailing current and destination contexts, making implicit projects explicit, visualizing scenarios, mandates and incentives
- Energy professionals can help:
  compare project development requirements to the scaled and accelerated deployment goals

Will the system supply candor?

- We must depend on experts. Even experts must depend on experts. (LEONARD E. READ, I, PENCIL (1958))
- Energy policy too important to be left entirely to proponents and experts.
- Trust citizens to understand the proposals, and they can better engage the experts on practicality and desirability.
- Candor can harden our resolve to accomplish bold things.
- We need that candor, and it ought to be supplied—by someone!

Looking forward to a candid discussion!

Rob James

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