An Energy Lawyer Looks At The Mobility Transition

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October 20, 2021
Environmental Law & Policy Colloquium
Stanford Law School

The energy mosaic

- Resources
  - Primary—fossil, biofuels, solar, wind, geothermal, hydro, nuclear
  - Secondary—electricity, refined fuels (gasoline, diesel, new fuels)
  - Transmission, storage, operation, decommissioning
- Applications
  - Industrial, commercial, infrastructure, ag, health, education, public
  - Mobility: Transportation (land/sea/air/space), transit, logistics
- Policies
  - Regulation of extraction, production, distribution and use
  - Regulation of externalities and of competition
  - National security, personal security, and other values

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The energy transition

- Renewable power generation
- Storage of power and heat
- Carbon consciousness for fossil fuels
- Hydrogen(s)
- Efficiency in applications
- Grid enhancements and distributed resources
- Greening of applications (including mobility)
- Advanced nuclear and other game-changing technologies
- *Throughout*, make energy affordable, sustainable, secure, just and equitable

Robert A. James, *Candor, Climate, and the Energy Transition,* 11 JOURNAL OF LAW (8 J. LEGAL METRICS) (forthcoming)

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Where does an energy law practice *stop*?

- ***Extraction, production, generation, transmission, storage, sure … but … what about***
- Smart and green buildings?
- Technology for grid and distributed resources?
- Urban, suburban and rural planning—at local, regional or national levels?
- Employment, trade and investment policy?
- Supply chains and the circular economy?
- Charging station infrastructure?
- Motor vehicles and public transit equipment and pathways?

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GoMentum

- New client since Amber asked me to speak *(whew!)*
- Venture of the American Automobile Association
- http://gomentumstation.net/
- Military ghost town returning to city of Concord
- Perfect conditions for testing self-driving motor vehicles
- Public and private parties' goal to foster more sophisticated R&D for autonomous and connected vehicles and infrastructure
- https://www.youtube.com/watch?v=rT9AqjVIhCA

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Today, examine the mobility transition

- Transportation and transit (fixed and variable)
- From cars to bikes, e-bikes and scooters
- From owned vehicles to car sharing, ride sharing, gig economy
- From internal combustion (including diesel) to renewable propulsion
- Hybrids, plug-in hybrids, electric (EV) and H_2/fuel cell vehicles
- Making the vehicles, the infrastructure, and the life-cycle
- Connected vehicles (CVs) and autonomous vehicles (AVs)
  - ***How do we plan for and incentivize supply and manufacture?***
  - ***How do we forecast and incentivize demand?***
  - ***What else in the world will change?***
  - ***Who wins and loses? How will we address equity and other values?***

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The once and future EV

- EVs c 1900, but ICEs prevail for most applications
- Not all, though—trolleys, some locomotives. DC v AC
- Game changers since 1990s: batteries/fuel cells, fossil v renewable technology, generation economics, and climate change
- Niches in 2000s & 2010s—hybrids, EV-1, Leaf, Volt, Tesla
- 2020s: California all new ZEVs by 2035, Biden policies, Ford F-150
- Not just batteries—also hydrogen and hydrogen fuel cells
- "U.S. Automakers Aspire to 50% EVs by 2030"
- International Energy Agency Global EV Outlook 2021

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EV supply and demand

- How do you make EVs for the entire economy?
- What materials and equipment needed at scale? Supply chains already perilous in 2020* and 2021**
- Ford: Commercial vehicles "10 years behind" personal vehicles; India behind Europe, China and even the U.S.
- Driving EV demand beyond the coastal niches
- Vehicles as mass distributed storage: Texas cold snap
- EVs can power your home! PUC policies needed to allow sales back into the grid

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What does an EV economy look like?

- Batteries—currently lithium-ion; iron-phosphate flow on way?
- Motors—rare earths and challenging metals
- Technology—from 25nm to 10nm or smaller chip features
- Charging technology—home, central, battery swaps—and all the associated infrastructure
- Hydrogen and fuel cell alternatives
- Cost and availability, equity—who can afford the full cost of the new EVs?

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What does an EV economy leave in its wake?

- Changes in manufacture—traction motors compared with ICEs need fewer and differently skilled workers (geography, training, union issues); global and local supply chain and logistics issues
- Changes in distribution—will EVs be purchased mostly in fleets? Impact on competition, car dealers, financing?
- Changes in charging—what happens to gasoline stations, aftermarket? Different time of day of electricity draws? End of free charging?
- Less repair and maintenance needs (apart from spent batteries)—impact on car repair, insurance, focus of liability?
- Ongoing and new safety and environmental risks—battery fires, ICE swaps, disposal issues, decommissioning?

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Overlay connected vehicles (CVs)

- CVs communicate bidirectionally with external systems
- U.S. Department of Transportation, CV Basics
- GM Onstar (1996), expansion to many manufacturers and fleets
- "V2X" technology is already here—to manufacturer, infra, other vehicles, pedestrians, devices, grid, net, cloud
- Open source standard (GSM), Google OAA, Apple CarPlay; export job to smartphones plus telematics box
- Privacy and cybersecurity risks, energy consumption

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Now, overlay autonomous vehicles (AVs)

- Add sensors (LIDAR/RADAR (real-time objects), HD GPS (location to the centimeter), Odometry (change in position and velocity), Inertial Measurement Units (IMUs for force, angular rate, orientation), and CV
- Advanced control systems, neural networks and machine learning
- SAE AV classes 0 (beeps, ABS), 1 (hands on, cruise), 2 (hands off, correction), 3 (eyes off, accident reaction), 4 (mind off, geofencing), 5 ("steering wheel optional")
- Legal, policy (and marketing) issues:
  safety, liability, security, cybersecurity, ethics;
- Transition from all-human to all-robot is tricky; see Kenneth Abraham & Robert Rabin's New Legal Regime for a New Era ("manufacturer enterprise responsibility")
- Unemployment for drivers and other mobility employees (robot taxes),
  even fewer organ donations
- The counter: 1.3MM killed, 20-50MM injured *annually* in vehicle accidents

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What roles will lawyers play?

- Regulatory – *what policies will apply and change as technologies are rolled out?*
  - Beginning-state, transitional-state, next-state (dialectical)
  - Environmental, economic, transportation, manufacturing, technology, security, cybersecurity…
- Financial – *what will be the sources and uses of funds and how will they be managed?*
  - Connecting manufacturers, tech developers, investors/financiers, EV/AV/CV fleets, users
  - Public-private partnerships, development and finance structures, logistics, sales and distribution
  - Which entities will own and govern the transition?
- Risk Management – *who will be liable when the LIDAR goes dark or haywire? Or someone hacks into the AV or CV network? Or a major blackout occurs?*
  - Part answered at the front end – assigning liability/responsibility in tort law, contract, insurance, business organizations, and government policies
  - Part answered at the back end – prospects for disputes, and wholesale or individual resolution

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Thanks!

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