PART I

Enhancing Secure and Reliable Access to Sustainable Energy Systems in the Twenty-First Century

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Tradeoffs and Tensions in the American Energy Transition

DAVID B SPENCE*

I. Introduction

Median public opinion in the United States on the question of the importance and urgency of action to address climate change has lagged behind most of the world's industrialised democracies. About six in ten US adults say they would 'favour' or 'strongly favour' policies that dramatically reduce the country's use of fossil fuels as a way to reduce greenhouse gas emissions and address climate change,[1] and a similar percentage see climate change as a 'major threat'.[2] By contrast there is near unanimity in support of those positions in most of western Europe.[3] Nevertheless, concern over climate is on the rise everywhere, and American climate policy is characterised by the lack of a durable national carbon policy, on the one hand, and a robust policy dialogue about policy change (mostly at the sub-national level), on the other. Within the last few years new plans to rapidly decarbonise the energy sector are peppering policy discourse and state and local law. These developments may reflect a growing sense that this is a particularly propitious moment to reduce carbon emissions from the electricity sector, because low-carbon electric generation resources have declined precipitously in price, stimulating customer demand for cheap, clean wind and solar power. At the same time, rapid decarbonisation presents difficult value choices for policymakers about how to manage persistent

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[1] J McCarthy, 'Most Americans Support Reducing Fossil Fuel Use' (*Gallup*, 22 March 2019) available at https://news.gallup.com/poll/248006/americans-support-reducing-fossil-fuel.aspx.

[2] F Moira and H Christine, 'A Look at How People around the World View Climate Change' (*Pew Research* Center, 18 April 2019) available at www.pewresearch.org/fact-tank/2019/04/18/a-look-at-how-people-around-the-world-view-climate-change/.

[3] European Social Survey, 'European Attitudes to Climate Change and Energy: Topline Results from Round 8 of the European Social Survey' (September 2018) available at www.europeansocialsurvey.org/docs/findings/ESS8_toplines_issue_9_climatechange.pdf.

tradeoffs in the energy sector between the objective of reducing carbon emissions, on the one hand, and providing a reliable, affordable energy supply, on the other.

Every policy choice made in the cause of decarbonisation implicates – that is, represents an implicit decision about – these tradeoffs. Each decision will make energy more or less expensive and/or reliable for some people. These choices ought to be an explicit part of the process of choosing energy-related decarbonisation policies but remain obscured in the current American policy dialogue. That fact can be ascribed to two forces shaping the American policymaking environment. The first is the ideological hyper-polarisation of American political parties and partisans. While six in ten Americans view climate change as an important threat, only three in ten Republicans (versus eight in ten Democrats) typically hold the same view. The second force is the rise of digital information dissemination and social media networks as the dominant platforms on which public policy discussion takes place. Together these forces lead us to ignore or assume away tradeoffs, which is likely to slow progress toward reducing carbon emissions from the electricity sector (and other sectors) in the end. After a brief description of the unique structure of the American electricity sector, this chapter explores the political-economic dynamics that suppress the kind of dialogue that might help policymakers grapple with the tradeoffs associated with a rapid green transition from a system that relies mainly on hydrocarbons towards one that predominantly comprises low- or zero-carbon energy sources.

II. The American Electricity Sector

The provision of electricity service in the United States has always been dominated by private ownership – specifically investor-owned utilities (IOUs).[4] An early 'public power' movement led some cities and towns to provide electricity service within their boundaries, but these municipal utilities have been the exception to the rule.[5] As with the railroads, most late-nineteenth and early twentieth century states and municipalities sought to attract private investment in the provision of electricity services by offering investors a government-chartered monopoly and a fair return (via regulated rates) on their prudently made investments. In return, IOUs understood that their returns would be no greater than those required to provide reliable service, that they would be required to serve all customers within their territories, and that they would be prohibited from discriminating by price within customer classes. By the early part of the twentieth century, IOUs provided electric service in most of the places where it made economic sense to do so: that is,

[4] J Wasik, *Merchant of Power Sam Insull, Thomas Edison, and the Creation of the Modern Metropolis* (Palgrave Macmillan, 2015).

[5] A Richardson and J Kelly, 'The Relevance and Importance of Public Power in the United States' (2005) 19 *Natural Resources & Environment* 54.

where there was sufficient population density and wealth to make the provision of service profitable according to these ratemaking rules. State public utility commissions regulated the terms and conditions (including price) by which IOUs provided monopoly service to customers within their territories. The Rural Electrification Act, part of the New Deal,[6] eventually provided a mechanism to bring electricity to poorer, more sparsely populated parts of the country not served by IOUs or municipal utilities, by facilitating the creation of rule electricity co-ops.[7]

By the second half of the twentieth century, virtually everyone in the United States received electricity service from a monopoly provider whose large, generating stations delivered power over the 'network-bound' largely centralised electric grid. About three-quarters of American customers were served by IOUs, with the remainder being served by municipal utilities and rural co-ops. IOUs were typically vertically-integrated in that they generated most of the power that they sold to their customers' municipal utilities and co-ops sometimes generated their own power, but often purchased power at wholesale from IOUs, and IOUs sometimes purchased power at wholesale from each other. These individual utility-owned systems were stitched together over time into a vast American electric grid that comprises three large grids: one covering the eastern part of the country, a second covering the western part, and a third that exists entirely within the state of Texas so that Texas may avoid certain aspects of federal regulation by refraining from interstate commerce in electricity.[8]

Because American customers were served by monopolies, regulators set the price of electricity. Regulatory jurisdiction in this system is bifurcated. The US Federal Power Act (FPA) gives the Federal Energy Regulatory Commission (FERC) ratemaking jurisdiction over wholesale sales and the transmission of electricity in interstate commerce; it reserves to the states the authority to site generators and set rates for retail sales and distribution. Both the FPA and its state analogues require that rates be 'just and reasonable', language that courts have interpreted to mandate a kind of qualified cost-minimisation rule. That is, utilities are entitled to earn a return on investment sufficient to provide reliable service to customers, but no more than that.[9] Critics of rate regulation note that this rule provides IOUs with an incentive to overinvest in assets or capital which may not be necessary for maintaining the basic reliability obligation; information asymmetries between IOUs and regulators may facilitate that overinvestment – a phenomena known within economics as the Averch-Johnson effect.[10] Worry about the Averch-Johnson

[6] The 'New Deal' is the name historians have given to the legislative programme proposed by President Franklin D Roosevelt to lift the United States from depression in the 1930s.

[7] JB Eisen et al, *Energy, Economics and the Environment: Cases and Materials* (Foundation Press, 2015) 29–73.

[8] DB Spence and D Bush, 'Why Does ERCOT Have Only One Regulator?' in LL Kiesling and And Kleit (eds), *Electricity Restructuring: The Texas Story* (Aei Press, 2009).

[9] *FCP v Hope Natural Gas Co*, 320 US 591 (1944).

[10] H Averch and L Johnson, 'Behavior of the Firm Subject to External Regulatory Constraint' (1962) 52 *The American Economic Review* 1052.

effect comprised part of the argument for the late twentieth century move toward competition and market pricing in the electricity sector.[11]

Regardless, electric utilities have assiduously followed the cost-minimisation rule in the way they dispatch (use) power plants to satisfy demand that fluctuates over the course of the day, or the year. Because electricity cannot be stored at commercial quantities, the electric grid must be kept in balance at all times in order to ensure reliable service.[12] Therefore, as consumer demand for electricity varies, grid operators must match those variations by varying the amount of electricity that generators dispatch to the grid in real time. And because individual utility systems are interconnected, this balancing takes place continuously across each of the three major American grids (Eastern Interconnect, Western Interconnect and Texas). Grid operators dispatch the available generators with the lowest marginal costs first, subject to the need to maintain reliability, a practice known in the industry as the 'security constrained economic dispatch' (SCED) rule.[13]

The SCED rule minimises costs because once the upfront capital costs of a generating unit are sunk, it is economically rational for the seller to minimise its marginal costs. For most generating units, the primary component of marginal costs is fuel (eg in a gas-fired or coal-fired unit, the costs attributed to the delivery through pipelines and the wholesale price of 'gas volumes' or coal respectively used as fuel). Therefore, dispatch order has been heavily influenced by historical fluctuations in the relative price of electric generation fuels. However, under traditional rate regulation, ratepayers pay not only for fuel costs but for capital costs and all of the other costs of providing electric service. Theoretically, IOUs and regulators minimised long run total costs to ratepayers by approving the construction of a diverse portfolio of generating plants that would be flexible enough to maintain reliable service and hedge against drastic changes in relative fuel prices. In any case, courts deem these cost minimisation rules to be required by the 'just and reasonable' rate requirement in public utility statutes.[14]

Beginning in the 1990s, regulators and state legislatures sought to introduce competition and market pricing into the electricity sector. The FERC took action in the mid-1990s to: (i) 'unbundle' (force the separation of) electricity transmission from wholesale power sales, forcing IOUs to open up access to the transmission grid to third parties, thereby introducing competition into wholesale power markets; and (ii) authorise wholesale sales of power at market (rather than administratively-set) prices. Around the same time, a minority of states – including California, Texas, New York and much of New England – took parallel

[11] SG Breyer and PW MacAvoy, *Energy Regulation by the Federal Power Commission* (Brookings Institution, 1974).

[12] That is, in order to keep the lights on, the American alternating current grid must be kept at a frequency of 60 Hz; if it deviates too far from this target, it fails. This is a feature of all alternating current grids, though some balance at frequencies other than 60Hz (North American Electric Reliability Corporation, 2011).

[13] Eisen et al (n 7) 695.

[14] Eisen et al (n 7) 695.

regulatory action to unbundle their retail markets, introducing competition and market pricing into retail sales. These moves jump-started previously moribund bulk power markets, as retailers started seeking power supplies from new and geographically-distant sources. This in turn stimulated the FERC to nudge IOUs to create regional governance institutions for wholesale power markets. Those governance institutions, known variously as Regional Transmission Organisations (RTOs) or Independent System Operators (ISOs), are non-profit associations of IOUs which manage the operation of regional transmission grids and oversee the operation of competitive wholesale power markets.[15] In RTO markets wholesale prices are set by supply and demand and vary across both time and locations on the regional system. This depends upon the cost of the marginal generator supplying power to that location and any congestion constraints impeding the flow of power to that location. In this way, the SCED rule is reflected in the connection between wholesale spot prices and the marginal cost of supplying power to specific places at specific times.

The spectacular failure of California's newly-competitive power market in late 2000 and early 2001 slowed the move toward restructuring in the other states, such that electricity markets in the United States now fall into one of three categories:

a) *traditional markets*, where rate regulation and vertically integrated monopolies continue to prevail;
b) *fully competitive markets*, where both wholesale and retail power markets are characterised by competition and market pricing; and
c) *hybrid markets*, where competition and market pricing reigns in wholesale power markets, but retail prices continue to be regulated.

Thus, twenty-first century American electricity markets are a polyglot. In many of the south-eastern states (traditional markets), customers continue to pay a single, regulated, volumetric rate for bundled service provided (and mostly generated) by their monopoly IOU. In that way, those markets incentivise investment in generation as they always have.

In fully competitive regions such as in New England, or states like Texas and New York, retail customers can shop for power from among a wide variety of retail sellers competing for their business. They pay a market price for power and a separate (regulated) fee to the monopoly provider of transmission and distribution services. Generators must recoup their costs from power sales (in New England and New York, but not in Texas) and they have the potential to earn capacity payments designed to incentivise sufficient generation reserves. Retailers secure the power they need to serve their customers on competitive wholesale markets overseen by RTOs/ISOs, like the New England ISO (ISONE), the Electric Reliability Council of Texas (ERCOT) or the New York ISO, respectively. Lastly, in hybrid states like

[15] DB Spence, 'Can Law Manage Competitive Energy Markets?' (2008) 93 *Cornell Law Review* 767; W Boyd, 'Public Utility and the Low-Carbon Future' (2014) 61 *UCLA Law Review* 1616.

Minnesota and Wisconsin, monopoly utilities continue to provide retail service at regulated rates, but purchase most of the power they sell to their customers on competitive wholesale markets overseen by the Midcontinent ISO.

III. The Green Transition in the United States

A. Regulatory Developments and Policy Momentum

As already noted, a clear majority of the American citizenry now accepts the reality and seriousness of climate change, but that national majority opinion is not reflected in national policy. After Congress failed to address carbon emissions in 2010,[16] the Obama Administration's so-called 'Clean Power Plan' (CPP) took the first steps toward regulating carbon emissions from the electricity sector by establishing guidelines for states' plans to limit carbon dioxide emissions from existing power plants.[17] The Trump Environmental Protection Agency (EPA), however, repealed the CPP in June 2019 and replaced it with its Affordable Clean Energy (ACE) rule,[18] which relaxes the CPP's limits on fossil-fuelled power plants.[19] The ACE rule reflects the preferences of a majority of Republican voters and politicians, who continue to oppose policies to reduce carbon emissions. Because of the lack of a coherent federal carbon emissions policy, what climate policy momentum exists in the United States can be found in state and local governments, or in academic and activist policy networks.

In recent years several states have established ambitious decarbonisation goals. In California, Governor Jerry Brown signed a bill mandating 50 per cent of California's electricity to be powered by renewable resources by 2025 and 60 per cent by 2030, while calling for a 'bold path' toward 100 per cent zero-carbon electricity by 2045.[20] Hawaii has established a goal of 100 per cent renewable electricity sources by 2045.[21] New York State's Climate Leadership and Community Protection Act calls for all the state's electricity to come from carbon-free sources

[16] Legislation to establish a cap and trade system for carbon emissions passed in the US House of Representatives in 2009, but failed in the Senate in 2010. H.R.2454–American Clean Energy and Security Act of 2009, available at www.congress.gov/bill/111th-congress/house-bill/2454.

[17] Environmental Protection Agency (EPA), 'Carbon Pollution Emission Guidelines for Existing Stationary Sources: Electric Utility Generating Units' (*EPA*, 23 Oct 2015), available at www.federalregister.gov/documents/2015/10/23/2015-22842/carbon-pollution-emission-guidelines-for-existing-stationary-sources-electric-utility-generating.

[18] EPA, 'Electric Utility Generating Units: Repealing the Clean Power Plan' (*EPA*, 19 June 2019), available at www.epa.gov/stationary-sources-air-pollution/electric-utility-generating-units-repealing-clean-power-plan#additional-resources.

[19] EPA, 'Affordable Clean Energy Rule' (*EPA*, 19 July 2019), available at www.epa.gov/stationary-sources-air-pollution/affordable-clean-energy-rule.

[20] California Public Utilities Code (hereinafter 'Cal. Pub. Util. Code') § 399.11 (2019); Cal. Pub. Util. Code § 399.15 (2019); Cal. Pub. Util. Code § 399.30 (2019).

[21] Hawai'i Revised Statutes (hereinafter 'Haw. Rev. Stat.') § 269–92.

by 2030, and for 70 per cent of which must be from renewable sources.[22] The State of Washington's 2019 Clean Energy Transformation Act requires all electric utilities in Washington to transition to carbon-neutral electricity by 2030.[23] New Mexico has mandated that the state's publicly regulated utilities receive all of their electricity from carbon-free sources by 2045.[24] And other states are establishing ambitious goals that nevertheless stop short of complete elimination of carbon emissions: for example, Minnesota law establishes a goal of reducing greenhouse gas emissions by 80 per cent by 2050.[25] Each of these state programmes is unique, establishing slightly different goals and timetables, and covering different combinations of business sectors, reflecting the absence of national policy in the federal American system.

In some places, the momentum for a green transition comes not from top-down policies but by bottom-up market demand. Conservative Republican Texas has more than three times as much wind-generating capacity as any other state, thanks to ample wind resources, low regulatory barriers to entry for generators, and the state's decision to build transmission lines to remote parts of west and north Texas where wind resources are strongest. The green transition is also happening at the local level. Aspen, Colorado, Georgetown, Texas and more than 100 other American cities have pledged to meet their electricity needs using '100 percent renewable' energy.[26] And several major IOUs have pledged to rapidly reduce their reliance on fossil fuels: Xcel Energy, serving parts of Minnesota and Colorado, has pledged to rely only on generation that emits no carbon dioxide at all (100 per cent emission reduction) by 2050.[27]

Another source of pressure for a more vigorous national climate policy comes from activist groups and other non-governmental organisations (NGOs) whose influence has been felt in the race for the Democratic Party nomination for the presidency in 2020. An NGO called the Sunrise Movement pushed the issue to the forefront with their 2018 proposal for a 'Green New Deal',[28] and in 2019 presidential candidates began embracing its terms in an attempt to attract the support of Democratic Party voters. Almost all of the presidential candidate plans call for the elimination of carbon emissions from the electricity sector by 2050,[29] and

[22] New York Environmental Conservation Law § 75–0103 (McKinney).

[23] Washington Revised Code Ann. § 19.285.040.

[24] Energy Transition Act, 2019 Bill Text NM S.B. 489 (official classification pending).

[25] Minnesota Statutes § 216H.02.

[26] '100% Commitments in Cities, Counties, & States' (*Sierra Club*, 5 April 2019) available at www.sierraclub.org/ready-for-100/commitments.

[27] 'Building a Carbon Free Future' (*Xcel Energy*, 2019) available at www.xcelenergy.com/staticfiles/xe/PDF/Xcel Energy Carbon Report -Feb 2019.pdf.

[28] See D Roberts, 'The Green New Deal, Explained' (*Vox*, 30 March 2019), available at www.vox.com/energy-and-environment/2018/12/21/18144138/green-new-deal-alexandria-ocasio-cortez.

[29] L Bloomer and C McCoy, 'In Which We Compare Democratic Presidential Candidates' Climate Plans – Environmental & Energy Law Program' (*Harvard Law School*, 5 September 2019), available at www.eelp.law.harvard.edu/2019/09/in-which-we-compare-democratic-presidential-candidates-climate-plans/.

some would aim to do so using only renewable energy (no nuclear or fossil-fuelled power).[30]

These bolder climate policy ambitions have been fed in part by aggressive rapid-decarbonisation plans and ideologies emerging from academia, some of which call for the construction of massive amounts of renewable energy infrastructure – a huge continental system of renewable generators connected by a new transmission network.[31] Furthermore, now that renewables are price competitive with traditional energy sources in many places, corporate customers are demanding more clean energy.[32] For example, the desire for cheap renewable power is driving proposals to build new transmission capacity linking: (i) the windy central plains to load centres to the East – cities like Minneapolis, Chicago, St Louis and Houston – where consumers want utility-scale wind power;[33] and (ii) transmission linking Texas wind power to consumers in the south-eastern gulf coast states.[34] Indeed, it may be that willing developer-sellers and corporate buyers of green power are unable to make these deals because of the legal and political difficulties of building interstate transmission lines. States retain a veto over transmission siting, and their legal regimes discourage (or outlaw) development of transmission by non-utilities.[35]

In any case, there appears to be a growing momentum for rapid development of cleaner energy sources in the United States. Some of it is coming from the bottom-up in the form of market demand for cheap, clean electricity. Some of it is coming from the top-down in the form of ambitious decarbonisation targets established by left-leaning states.

[30] This is true of the plans put forth by Senator Bernie Sanders and Senator Elizabeth Warren. *Ibid*.

[31] See MZ Jacobson et al, 'Low-Cost Solution to the Grid Reliability Problem with 100% Penetration of Intermittent Wind, Water, and Solar for All Purposes' (2015) 112 *Proceedings of the National Academy of Sciences* 15060 (calling for the construction of a continental high-voltage transmission system to connect new and far flung utility-scale renewable generators). Others note that this plan contemplates a level of transmission and generation investment that is 14 times historic annual rates; Clack C et al, 'Evaluation of a Proposal for Reliable Low-Cost Grid Power with 100% Wind, Water and Solar' (2017) 114 *Proceedings of the National Academy of Sciences* 6722.

[32] See J Pyper, 'The Latest Trends in Corporate Renewable Energy Procurement' (*Greentech Media*, 30 June 2017), available at www.greentechmedia.com/articles/read/the-latest-trends-in-corporate-renewable-energy procurement (describing exponential growth in demand recently); D Gardiner and Associates, 'The Growing Demand for Renewable Energy Among Major U.S …' (12 September 2017), available at www.dgardiner.com/wp-content/uploads/2017/09/Renewable-Energy-and-Climate-Commitments-in-the-Manufacturing-Sector_FINAL9.19.2017FINAL.pdf (describing the prevalence of clean energy goals among major manufacturers).

[33] Perhaps the best way to visualise this agenda is to view the map of transmission projects proposed by Clean Line Energy Partners, a merchant transmission company seeking to connect wind farms in the central plains to cities to the East. That map is viewable at: www.cleanlineenergy.com/projects.

[34] The role of the Southern Cross Transmission Project bringing Texas wind power to south-eastern states is explained at the project web site, www.southerncrosstransmission.com.

[35] For descriptions of this problem see: R Gold, *Superpower: One Man's Quest to Transform American Energy* (Simon & Schuster, 2019) (telling the story of Clean Line Energy, a failed merchant transmission developer whose business model aimed to support wind energy); DB Spence, 'Naive Energy Markets' (2017) 92 *Notre Dame Law School* 973.

B. Affordability and Reliability Tradeoffs – Are they Real?

If there is to be a rapid transition to drastically lower carbon emissions in the electricity sector, it will require decisions about how managers of the electric grid maintain a reliable supply as intermittent wind and solar generators comprise an ever-larger share of the generation mix. This is an issue that has been plagued by a 'cry wolf' problem in the past. Grid managers have claimed that relatively low penetrations of wind and solar would disrupt the reliability of the energy supply, only to find that the system could accommodate far larger penetrations into the market without jeopardising reliability. Wind and solar generation now regularly exceed 50 per cent of power in parts of the country, sometimes for relatively long stretches of time, without outages. Grid operators have made great strides forecasting wind and adjusting grid management and electricity market institutions to accommodate the unique characteristics of wind power. On the other hand, the variability of wind and solar power do pose new challenges to grid operators. There is *some* level of wind and solar penetration that poses reliability (or cost) problems, in part because the wind sometimes doesn't blow, and the sun doesn't shine. In other words, even though integrating renewable power into the electric mix is getting cheaper and easier, we still depend on non-renewable sources when the wind doesn't blow, and the sun doesn't shine at the time and scale required. Without those resources, will the lights remain on? Can we afford to pay for their replacement by zero-carbon generation and storage?

Three rejoinders are often used to assuage this concern. One rejoinder to worries about the cost of a reliable, 100 per cent renewable energy-based system is that the alternative is even more costly. Fossil fuel combustion, and particularly coal combustion, imposes enormous costs on society in the form of premature deaths and other harms to human health and the environment. We have experience valuing those costs, and they are indeed huge.[36] Many analysts conclude that the total costs (including social costs) of a zero emission energy system will be lower than those associated with the current energy mix.[37] But out-of-pocket costs matter too, because someone must pay for the construction of new infrastructure necessary to make the transition a reality. A greener energy system will impose more out-of-pocket costs than the current system does. Acknowledging that fact and making decisions about how those costs should be distributed, are important

[36] See PR Epstein et al, 'Full Cost Accounting for the Life Cycle of Coal' (2011) 1219 *Annals of the New York Academy of Sciences* 73 (assessing the costs associated with coal production in the hundreds of billions, much of it associated with premature deaths); and NZ Muller, R Mendelsohn and W Nordhaus, 'Environmental Accounting for Pollution in the United States Economy' (2011) 101 *American Economic Review* 1649 (estimating the mortality and morbidity harm associated with coal combustion at more than 50 times that of natural gas combustion); L Chen, SA Miller and BR Ellis, 'Comparative Human Toxicity Impact of Electricity Produced from Shale Gas and Coal' (2017) 51 *Environmental Science & Technology* 13018 (documenting similarly disparate impacts from discharges of toxics over the life cycle of coal and natural gas for use as electricity fuels).

[37] Jacobson et al (n 31).

elements of a just and reasonable green transition. Hence the enormous price tags attached to proposals like the Green New Deal.[38] Those distributional cost impacts will shape the politics of pursuing a green grid.

A second rejoinder (offered most often by economists) is to say that we can simply let the market make these tradeoffs for us if we get prices right by imposing a carbon tax. This may be conceptually true, and even a modest carbon tax would hasten reductions in carbon emissions from the power sector.[39] However, there is considerable disagreement among policy analysts about the appropriate size of the tax, whether it should be revenue-neutral, and more production vs consumption focused. And like most taxes, carbon taxes are not popular with voters, and the prospects for a national carbon tax appear remote.

A third rejoinder to worries about affordability and reliability is to deny that a green transition poses reliability and affordability tradeoffs in the first place, because renewable power is already less expensive than the alternatives; indeed, cities and companies are already purchasing 100 per cent renewable power. Political jurisdictions[40] and companies[41] that have pledged to consume only renewable energy now or in the future will (with very few exceptions) continue to consume electricity, some of which comes from non-renewable sources, for at least the next several decades. Even though those consumers contract to purchase electricity only from renewable generators (or buy renewable energy credits) in amounts that represent all of their annual consumption, the electricity they take from the grid cannot be directed to specific consumers; nor is there sufficient grid-connected renewable power to serve demand at all times (say, on still nights). In that sense, these 100 per cent renewable consumers effectively rely in part on non-renewable power.[42]

It is true that renewables are indeed cheapest on a levelised-cost basis: that is, if we assume that generators can sell all the power they generate over the course of their useful life, wind and solar generators can turn a profit at a lower average power price than gas-fired, coal-fired or nuclear generators.[43] However, unlike

[38] Proponents of the Green New Deal overcome cost limitations by assuming that the Federal Government can fund trillions of dollars of spending on a new green grid through a combination of public debt and quantitative easing. A macroeconomic theory called 'modern monetary theory' or 'modern money theory' differs from mainstream macroeconomic theory in its optimism about the ability of the US Government to issue large amounts of additional public debt without significantly chilling demand for that debt, and to increase the money supply without triggering inflation. This is partly why the Sanders campaign proposes federal ownership of most of the new green grid.

[39] D Adelman and D Spence, 'U.S. Climate Policy and the Regional Economics of Electricity Generation' (*Energy Policy*, September 2018), available at www.sciencedirect.com/science/article/pii/S0301421518303112?via%3Dihub.

[40] See Sierra Club's list of '100% renewable' cities at: www.sierraclub.org/ready-for-100/commitments.

[41] An organisation called 'RE100' keeps track of companies that have pledged to secure 100% renewable power. That list can be found at: www.there100.org/companies.

[42] J Rhodes, 'What Does 100% Renewable Energy Really Mean?' (*Forbes*, 22 August 2018), available at www.forbes.com/sites/joshuarhodes/2018/08/21/what-does-100-renewable-energy-really-mean/#50b094fe1ac8.

[43] J Lazard, 'Lazard's Levelized Cost of Energy Analysis -Version 12.0' (*Lazard*, November 2018), available at www.lazard.com/media/450784/lazards-levelized-cost-of-energy-version-120-vfinal.pdf.

those other technologies, wind generators cannot be counted upon to back up other wind generators (and other solar generators) because they tend to generate power during the same – or substantially overlapping – subsets of the day and year. Might excess wind and solar power be stored for later use during daily or seasonal wind and solar droughts? The costs of battery storage have been falling, and more 'solar plus storage' projects are being built, financed by long-term power purchase agreements with utilities or other buyers. Given the downward cost trajectory of battery storage, these systems may offer a zero-carbon answer to the daily supply problem (overnight supply).

In traditional, vertically integrated utility systems, these projects can thrive. In competitive markets, they face some challenges. A glut of renewable power at certain times (of the day or year) improves the economics of operating a storage system because it reduces the costs of storage; but it hurts the economics of operating a wind or solar generator because it means that wind and solar farms will either have to pay to 'sell' their power to storage facilities (negative pricing), or will not be able to sell to anyone during glut periods. Either way, this weakens the business case for developing a renewable generation facility in the first place. Stated differently, if the generator must recover its costs of operation from the sale of fewer kilowatt-hours of electricity during its useful life, its levelised costs go up. In lay terms, it must command higher prices for its product.

That seems unlikely in a market in which the spot price is determined by the marginal cost of the last-dispatched generator, and more and more (renewable) generators have zero marginal costs. In traditional markets, IOUs can recover the costs of building (or buying from) a renewable generator; in competitive markets, they cannot. In some competitive wholesale markets, generators can earn capacity payments, but ISOs and RTOs sometimes make it difficult for renewable generators to compete for those payments.[44] In one American market – Texas – regulators use scarcity pricing to incentivise investment in reserve generation capacity. Wholesale prices can rise as high as $9000/mwh there. However, reserve capacity has fallen almost 50 per cent below the regulators' targets there, and it remains to be seen whether scarcity pricing alone will incentivise investment in an adequate supply of reserves there.

Bluntly put, the prospect of having to compete with other renewable generators for scarce buyers during oversupply periods will make these facilities difficult to finance absent very high scarcity prices or some sort of price guarantee from government or other market overseers like RTOs and ISOs. Moreover, even if we build a continental grid connecting massive additional numbers of wind and solar generators, that is unlikely to entirely eliminate the need for some form of additional

[44] J Macey and S Salovaara, 'Rate Regulation Redux' (*University of Pennsylvania Law Review*, 2019), available at https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3362920.

back-up supply to cover rare-but-inevitable long wind or solar droughts.[45] Might storage of renewable power offer a solution to seasonal renewables droughts?

Technologies like pumped storage hydro or compressed air storage have much longer duration, and have lower levelised costs of storage compared to batteries. But they are large capital projects unlikely to be financed absent revenue guarantees that are not yet forthcoming from the market or from governments. Given what we know about wind and solar variability and the current cost of long-term (more than four hours) battery storage, transforming that supplementary power into zero-carbon (emissions) power will require some combination of changing economics and mandates. Without those mandates, conservative Republican states are likely to keep natural gas generators on the grid for back-up supply, because it is more expensive to build a large enough system of (rarely used) wind farms, solar arrays, transmission lines and batteries necessary to ensure a reliable supply. Left-leaning states seem more willing to push the market in that direction. California, for example, is actively pushing to reduce emissions from back-up power supplies. Californians hold more negative attitudes toward natural gas, and the state aggressively subsidises batteries and other kinds of electricity storage in an attempt to lay the foundation for a truly 100 per cent renewable power supply: one that generates renewable energy for direct use now and also stores it for use later when the wind isn't blowing and the sun isn't shining. Presumably those presidential candidates whose plans exclude nuclear and fossil-fuelled generation from the future generation mix assume the existence of an affordable set of storage options for renewable power in the future.[46] That is a big assumption.

A small number of political jurisdictions and firms have access to sufficient amounts of dispatchable renewable resources – like geothermal power or hydroelectric power operated in storage mode – to provide sufficient back-up supply in the face of these short-term weather conditions. Iceland, for example, has ample geothermal and hydroelectric power that is generally dispatchable when needed. In the United States, where wind and solar are the dominant renewable resources, some sort of more traditionally-dispatchable source of power (or electricity storage) is needed to fill in when the wind isn't blowing, and the sun isn't shining. Moreover, building a truly 100 per cent renewable electric grid would require building an enormous amount of mostly-redundant renewable generation to compensate for regional variation in wind and charge electricity storage facilities, as well as much more electricity storage and transmission capacity. Right now, that kind of commitment looks technically possible but politically unrealistic and

[45] Energy and Environmental Economics, Inc (E3), 'A Study of Policies to Decarbonize the Electric Sector, Pacific NW' (2017), available at www.ethree.com/projects/study-policies-decarbonize-electric-sector-northwest-public-generating-pool-2017-present/. E3, 'Resource Adequacy in the Pacific NW' (2019), available at www.ethree.com/wp-content/uploads/2019/03/E3_Resource_Adequacy_in_the_Pacific-Northwest_March_2019.pdf.

[46] Senator Bernie Sanders' plan is framed this way.

expensive: a little like jumping off a cliff and hoping to invent a parachute on the way down.

One meta-analysis concludes that including firm low-carbon (but non-renewable) resources is more achievable, less expensive, and yields a more reliable low- or zero-carbon electric system.[47] Some other analyses conclude that the out-of-pocket price of a renewables-only supply is very high. Wood McKenzie puts the cost of such a system at $35,000 per US household.[48] The American Action Forum puts the cost at $5.7 trillion, or $42,000 per household.[49] Others have highlighted a different kind of cost – namely, the magnitude of the scaling problem inherent in a rapid transition, which in turn implicates environmental issues. A massive build-out of wind, solar and batteries consistent with a zero-carbon emission future implies huge increases in world outputs of copper, zinc, aluminum, lead, silver, cadmium, lithium and various other minerals that are used in the production of these forms of energy production and storage. One analysis put the increase in lithium production above current levels at 2700 per cent. Many of these supplies come from countries with lax environmental standards.[50] Thus, the environmental and security-of-supply implications create a separate dilemma and set of externalities that are often under-emphasised or overlooked.

For the time being, it's much cheaper to back up renewable power with non-renewable, firm resources. Perhaps by 2045 that no longer will be true. This reality may explain the difference between presidential candidates' promises to phase out nuclear and gas-fired generators, and state plans' focus on eliminating emissions rather than particular fuels. The plan proposed by Senator Bernie Sanders comes with a $16.3 trillion price tag, some of which may be attributable to the need for a massive build-out of (rarely used) back-up generation, transmission and storage infrastructure. Senator Sanders' energy plan and the Sunrise Movement's Green New Deal have common roots (Sanders calls his plan the 'Green New Deal'), and both are apparently premised on the notion that federal financing of new green infrastructure can be used to avoid imposing costs on ratepayers. Citing a strain of

[47] JD Jenkins and S Thernstrom, 'Deep Decarbonization of the Electric Power Sector: Insights from the Recent Literature' (*Energy Innovation Reform* Project, March 2017), available at www.innovationreform.org/wp-content/uploads/2018/02/EIRP-Deep-Decarb-Lit-Review-Jenkins-Thernstrom-March-2017.pdf; and NA Sepulveda et al, 'The Role of Firm Low-Carbon Electricity Resources in Deep Decarbonization of Power Generation' (2018) 2 *Joule* 2403.

[48] D Shreve and W Schauer, 'Decarbonisation' (*Decarbonisation*, June 2019), available at www.decarbonisation.think.woodmac.com/; See also I Gheorghiu, 'Transitioning US to 100% Renewables by 2030 Will Cost $4.5 Trillion: Wood Mackenzie' (*Utility Dive*, 28 June 2019), available at www.utilitydive.com/news/transitioning-us-to-100-renewables-by-2030-will-cost-rate-payers-45t-wo/557832/; A Watts and T Benson, 'Analysis: Cost Of U.S. Transition To 100% Renewables – $4.5 Trillion' (*Watts Up With That?*, 9 July 2019), available at www.wattsupwiththat.com/2019/07/09/analysis-cost-of-u-s-transition-to-100-renewables-4-5-trillion.

[49] P Rossetti, 'What It Costs to Go 100 Percent Renewable' (*American Action Forum*, 25 January 2019), available at www.americanactionforum.org/research/what-it-costs-go-100-percent-renewable.

[50] J Hickel, 'The Limits of Clean Energy' (*Foreign Policy*, 6 September 2019), available at www.foreignpolicy.com/2019/09/06/the-path-to-clean-energy-will-be-very-dirty-climate-change-renewables/.

macroeconomic theory called 'modern monetary theory', proponents of the Green New Deal contend that the Federal Government can pay for it by issuing enough government debt and/or increasing the money supply to cover the tens of trillions of dollars it is estimated to cost without triggering inflation or harming the creditworthiness of the American Government.[51] This is apparently not a mainstream macroeconomic view, but it is gaining adherents among the American progressive left.

Can some of these tradeoff problems be solved by reducing reliance on the electric grid in the first place, and instead generating energy and using it more efficiently at home, or in local microgrids, ie distributed and decentralised energy systems? Perhaps, if technology improves and becomes less costly. Microgrids and home devices can add resiliency to parts of a system, but right now going completely off the grid means more expensive, less reliable energy in most places. For example, the average cost of generating electricity from rooftop solar units is several times higher than the cost of generating it at utility-scale solar farms and sending it to customers.[52] And owners of rooftop solar units do not merely supply their own homes and businesses with the power they generate; rather, the owner of a rooftop unit typically consumes power from the grid when the sun isn't shining and dispatches excess power to the grid when the sun is shining. Not only do owners of rooftop solar continue to depend upon grid power, they are often compensated for the excess power they sell to the grid more generously than owners of utility-scale solar units. In many jurisdictions, the consumer is compensated at the retail rate (rather than the wholesale rate) for the power it sells to the grid, a practice called 'net metering'. There is considerable disagreement about the appropriate compensation level for that power, but there is no disagreement that this practice tends to shift out-of-pocket grid costs from (relatively wealthy) adopters of solar units to non-adopters.[53]

On the other hand, there are important legal and political obstacles to building the transmission system we need to support the green grid.[54] State vetoes and local opposition make taking advantage of cheaper, more equitably priced utility scale renewable power difficult. If those obstacles cannot be overcome, perhaps a more decentralised (albeit more expensive) system may offer a second-best route to a greener electricity system by avoiding difficult political tradeoffs.

[51] S Horsley, 'This Economic Theory Could Be Used To Pay For The Green New Deal' (*NPR*, 17 July 2018), available at www.npr.org/2019/07/17/742255158/this-economic-theory-could-be-used-to-pay-for-the-green-new-deal.

[52] Lazard (n 43).

[53] S Burger, '#16 – The Economics of Rooftop Solar' (*SoundCloud*), available at www.soundcloud.com/mitenergy/the-economics-of-rooftop-solar; and S Burger, 'Rate Design for the 21st Century: Improving Economic Efficiency and Distributional Equity in Electric Rate Design' (Massachusetts Institute of Technology, PhD Dissertation, 9 August, 2019), available at www.dropbox.com/s/gsox-1prub8cj193/190726_Dissertation_Burger_Final.pdf?dl=0.

[54] DB Spence, 'The New Politics of (Energy) Market Entry' (2019) 95 *Notre Dame Law Review* 327.

Green ambitions implicate a number of difficult value and distributional choices – tradeoffs that politicians and policymakers will decide more or less explicitly. Unfortunately, the polarisation and emotional intensity that characterises energy politics in the United States makes it difficult to address those tradeoff questions openly and honestly.

i. The Politics of Tradeoffs

Two interrelated societal forces seem to be intensifying conflict over energy infrastructure in the twenty-first century. One is the shift of information exchange and policy discussion on to digital platforms, and the other is the well-documented hyper-polarisation of the American polity. At first, scholars treated the rise of digital media and the Internet as a force for social integration. The integration argument sees digital inter-connectedness as likely to expose citizens to a broader set of views, improving civic culture and promoting deliberative democracy.[55] More recent scholarship, however, contradicts that optimistic view and points instead to fragmented internet subcultures and homogenous opinion ecosystems that contribute to ideological polarisation among the politically-active portion of the population, in part by inoculating belief against the effects of new information.[56] These technological changes, in turn, may be both a cause and a consequence of increasing ideological polarisation of American political parties, particularly over the issue of government intervention in the market (regulation), including energy markets.

By any of several measures, Congress is more ideologically polarised than ever before in the modern regulatory era. The parties have grown steadily farther apart ideologically since the 1970s, making bipartisan action to address important problems like climate change much more difficult. A large and growing academic literature has documented this growing polarisation.[57] Keith Poole and Howard

[55] P Dahlgren, 'In Search of the Talkative Public: Media, Deliberative Democracy and Civic Culture' (2002) 9 *Javnost-The Public* 5; J Kim, RO Wyatt and E Katz, 'News, Talk, Opinion, Participation: The Part Played by Conversation in Deliberative Democracy' (14 November 2014) 16 *Political Communication* 361; DV Shah et al, 'Information and Expression in a Digital Age' (2005) 32 *Communication Research* 531; and Cramer Walsh K, *Talking About Politics: Informal Groups And Social Identity In American Life* (The University of Chicago Press Books, 2004).

[56] MD Vicario et al, 'The Spreading of Misinformation Online' (2016) 113 *Proceedings of the National Academy of Sciences* 554; MD Vicario et al, 'Mapping Social Dynamics on Facebook: The Brexit Debate' (2017) 50 *Social Networks* 6; M Schudson, 'Why Conversation Is Not the Soul of Democracy' (1997) 14 *Critical Studies in Mass Communication* 297; and DC Mutz, 'Impersonal Influence: How Perceptions Of Mass Collectives Affect Political Attitudes' (1998) 12 *Critical Studies In Mass Communication*.

[57] For a good overview of the various databases and theories of congressional polarisation, and an integration of some of those theories and data, see SM Theriault, Party Polarization In Congress (Cambridge University Press, 2008); JH Aldrich, Why Parties?: The Origin and Transformation of Political Parties in America (University of Chicago Press, 2007); KT Poole and H Rosenthal, *Ideology & Congress: A Political-Economic History of Roll Call Voting* (Transaction Publishers, 2007); MP Fiorina and SJ Abrams, 'Political Polarization in the American Public' (2008) 11 *Annual Review of Political Science* 563; MP Fiorina, 'Whatever Happened to the Median Voter?' (Midwest Political Science Association Annual Meeting in Chicago, Illinois, 1999).

Rosenthal's DW-NOMINATE dataset places members of Congress on an ideological spectrum based upon voting behaviour.[58] They conclude from their data that polarisation in the US House and Senate are at their highest levels since the end of Reconstruction.[59]

It seems almost self-evident that polarisation would increase the emotional intensity of political conflict, in two ways. First, as the parties' policy agendas grow farther apart ideologically,[60] each agenda appears increasing unacceptable – even alarming – to members of the opposite party, making political victory seem an ever more important moral imperative. If politically active Democrats and liberals see reducing carbon emissions as an urgent national priority requiring government attention, the unwillingness of Republicans and conservatives to support that urgent project seems alarming.[61] At the same time, if increasing numbers of Republicans and conservatives equate unregulated markets (including energy markets) with freedom and the good, see regulators as part of a dangerous and anti-democratic 'deep state', and characterise regulation as antithetical to freedom,[62] then a massive, rapid, government-centred green transition appears to be equally alarming. Second, in Congress,[63] polarisation begets gridlock[64]

[58] For a thorough explanation of these data and how they document increasing polarisation in American politics, see KT McCarty, KT Poole and H Rosenthal, Polarized America: *The Dance of Ideology and Unequal Riches* (MIT Press, 2006). For a striking visual illustration of polarisation in Congress, see Keith Poole's web page, available at https://legacy.voteview.com/Polarized_America.htm.

[59] K Poole, 'Voteview web page', available at voteview.com.

[60] The most commonly cited database illustrating ideological polarisation between the congressional parties is the so-called 'DW-NOMINATE' maintained by Keith Poole and others. Analyses of that data indicate that the parties in Congress are farther apart ideologically than at any time after the Second World War, and that 'role of government' issues drive polarisation.

[61] S Macdonald, 'Bill McKibben: Pope's Encyclical Gives Everyone "Marching Orders" on Climate' (National Catholic Reporter, 30 June 2015), available at www.ncronline.org/blogs/eco-catholic/bill-mckibben-pope-s-encyclical-gives-everyone-marching-orders-climate.

[62] Some trace the rise of this view to the funding of academic research by conservative funders, like the Koch Brothers foundations. N Maclean, *Democracy in Chains* (Penguin Random House, 2017). Others trace its origins to the growing influence of Austrian economics and conservative philosophy. See, eg, FA Hayek, *The Road to Serfdom* (Routledge, 1944) (laying out the argument that social welfare is maximised by free exchange in ways we cannot know or estimate ex ante); MN Rothbard, *Man Economy and the State: a Treatise on Economic Principles* (Van Nostrand, 1962) (arguing that democratic governance is coercive, and that social organisation by bilateral bargaining maximises welfare); and R Nozick, Anarchy, *State and Utopia* (Basic Books, 1974) (advancing a case for a minimal state lying somewhere between Hayek and Rothbard).

[63] The causes of congressional polarisation are disputed, but are ascribed by scholars to a variety of factors, most of which fall within either of two categories: one focusing on the increasing ideological homogeneity in congressional districts. B Bishop, *The Big Sort: Why the Clustering of like-Minded America Is Tearing Us Apart* (Mariner Books, 2009); JM Stonecash, MD Brewer and M Mariani, *Diverging Parties: Social Change, Realignment, and Party Polarization* (Westview Press, 2002); JL Carson et al, 'Redistricting and Party Polarization in the U.S. House of Representatives' (2007) 35 *American Politics Research* 878. A second set of diagnoses focus on various kinds of institutional factors that affect how parties manage congressional business. See GC Layman, TM Carsey and JM Horowitz, 'Party Polarization in American Politics: Characteristics, Causes, and Consequences' (2006) 9 *Annual Review of Political Science* 83; RH Pildes, 'Democracy, Anti-Democracy, and the Canon' (2011) 99 *California Law Review* 273.

[64] See S Binder, *Stalemate: Causes and Consequences of Legislative Gridlock* (Brookings Institution Press, 2003).

much of the time, which frustrates the policy agendas of any group seeking policy change. Conservatives have a difficult time repealing regulatory regimes they view as oppressive obstacles to progress, leaving those regimes in place; for their part, liberals cannot legislatively regulate greenhouse gas emissions or establish national standards for renewable energy.[65] In this way, gridlock further increases both groups' frustration.

The presidential election of 2016 revealed another source of centrifugal force in American politics: namely, the ability of interested parties to shape belief, and to mislead, using the tools of modern digital communication.[66] Long before the modern behavioural revolution,[67] political philosophers and psychologists recognised that propagandists can shape belief by playing to the cognitive biases. James Madison's admonition in 'Federalist No. 10' that a person's reason and passion have 'reciprocal effects' on one another is an acknowledgment that emotion feeds bias.[68] Henry Adams' description of politics as the 'systematic organization of hatreds' was a more blunt and condemnatory assessment of the manipulation of biases on American politics.[69] Academic psychologists began to chronicle the idea of biases in the early part of the twentieth century.[70] What *is* new is the speed and effectiveness with which these biases can now be exploited using modern communication tools.

Today, information about energy and environmental policy is transmitted online through news aggregators, or links sent to friends via online social communities. This way of acquiring and digesting (socially) new information tends to skew our understanding of the energy tradeoffs, as algorithms feed us more of what we like and less of what we dislike. Consequently, we form and harden our beliefs much more quickly in the digital environment. In the debate about the green transition, it becomes more difficult to respectfully debate questions associated with tradeoffs, and much easier to ascribe malicious or otherwise nefarious

[65] For a description of the failure of carbon regulation at the national level, see B Walsh, 'Why the Climate Bill Died' (*Time*, 26 July 2010), available at www.science.time.com/2010/07/26/why-the-climate-bill-died.

[66] M McKew, 'Did Russia Affect the 2016 Election? It's Now Undeniable' (*Wired*, 17 February 2018), available at www.wired.com/story/did-russia-affect-the-2016-election-its-now-undeniable/; and G O'Connor and A Schneider, 'How Russian Twitter Bots Pumped Out Fake News During The 2016 Election' (*NPR*, 3 April 2017), available at www.npr.org/sections/alltechconsidered/2017/04/03/522503844/how-russian-twitter-bots-pumped-out-fake-news-during-the-2016-election.

[67] For summaries of the Kahneman and Tversky research, see D Kahneman, *Thinking, Fast and Slow* (Farrar, Straus and Giroux, 2013); and D Kahneman and A Tversky (eds), *Choices, Values, and Frames* (Cambridge University Press, 2000).

[68] James Madison, 'The Federalist No. 10' in *The Federalist Papers* (*The Independent Journal*, 1787).

[69] H Adams, 'Chapter One: Quincy' in *The Education of Henry Adams* (1918).

[70] For a history of the idea of confirmation bias, for example, see RS Nickerson, 'Confirmation Bias: A Ubiquitous Phenomenon in Many Guises' (1998) 2 *Review of General Psychology* 175. Confirmation bias applies irrespective of the truth or falsity of the belief. *Ibid* at 188 ('not only can it contribute to the perseverance of unfounded beliefs, but it can help make beliefs for which there is legitimate evidence stronger than the evidence warrants'). Leon Festinger's work on cognitive dissonance and rationalisation dates to the mid-20th century. See L Festinger, *A Theory of Cognitive Dissonance* (Sandford University Press, 1957).

motives to those whose policy preferences or understanding of the issues differs from ours. No doubt these trends are amplified during the ever-lengthening American political campaign season.

More specifically, our reliance on digital communication media creates 'filter bubbles' that limit information flows and homogenise (ideologically) social networks.[71] These are the networks exploited by Russian bots in the 2016 election, and more generally by digital marketers. Where Americans once relied on a few sources of curated news, on the Internet they are now confronted with vast amounts of uncurated information presented as 'news'. Human nature reacts to this not only by selecting information sources that feed our biases; in addition, Twitter, Facebook and other platforms employ algorithms that amplify those biases in ways we never see. In this way, digital communities accelerate the effects of confirmation bias,[72] and feed the increasingly segmented cultural identities that shape our politics and our receptivity to new information about risk.[73] Emotional messages spread faster across social media than factual messages do.[74] Furthermore, if filter bubbles become too insular, false factual beliefs (about climate science, economics, or anything) can persist. For example, Noah Friedkin and Francesco Bullo find that when a false belief about a scientific fact predominates in most groups, the truth can eventually win out 'if any individual who understands the relevant science or mathematics must come to the [truthful] conclusion'; but this finding does not hold 'when social movements or social media elevate the adoption of a particular set of false facts and logic'.[75]

Thus, for example, Trump loyalists and Democratic Party loyalists hold not only different values, but also diametrically opposed beliefs about what is true over a wide variety of subjects – including the drivers and severity of climate change.[76] Online communities reinforce members' outrage about opposition positions and beliefs: 'the right is destroying our home, the earth', and 'the left is destroying our freedom'. The combination of targeted messaging and emotion is a powerful one

[71] E Pariser, *The Filter Bubble: How the New Personalized Web Is Changing What We Read and How We Think* (Penguin Books, 2011).

[72] Nickerson (n 70).

[73] See M Douglas and A Wildavsky, *Risk and Culture: An Essay on the Selection of Technical and Environmental Dangers* (University of California Press, 1982); and DM Kahan and D Braman, 'Cultural Cognition and Public Policy' (2006) 24 *Yale Law & Policy Review* 147.

[74] S Stieglitz and L Dang-Xuan, 'Emotions and Information Diffusion in Social Media – Sentiment of Microblogs and Sharing Behavior' (2013) *Journal of Management Information Systems* 217.

[75] NE Friedkin and F Bullo, 'How Truth Wins in Opinion Dynamics along Issue Sequences' (2017) 114 *Proceedings of the National Academy of Science* 11380.

[76] L Griffin and A Neimand, 'Why Each Side of the Partisan Divide Thinks the Other Is Living in an Alternate Reality' (*The Conversation*, 18 May 2019), available at www.theconversation.com/why-each-side-of-the-partisan-divide-thinks-the-other-is-living-in-an-alternate-reality-71458; B Azarian, 'An Analysis of Trump Supporters Has Identified 5 Key Traits' (*Psychology Today*, 31 December 2017), available at www.psychologytoday.com/us/blog/mind-in-the-machine/201712/analysis-trump-supporters-has-identified-5-key-traits (suggesting reasons why Trump voters accept the President's demonstrably false statements).

that marketing professionals have long exploited to their advantage. Policy activists and interest groups on both sides of the ideological divide are now beginning to do so as well: that is, to employ data analytics to take advantage of these characteristics of digital and social media platforms, in order to better test the appeal and effectiveness of political messages to specific audiences.[77] These sophisticated message targeting efforts may explain why voter polarisation apparently increases with voter engagement in politics and policy debate, implying that activists can drive polarisation among the rank-and-file.[78]

All of this makes grappling openly and collaboratively with difficult tradeoffs inherent in a green transition nearly impossible. Proponents of the Green New Deal feature prominently in election fundraising appeals by conservatives, who depict the plan as socialism run amok.[79] Conversely, in the context of intense political conflict there are strategic reasons why progressives may not want to talk openly about tradeoffs either. Discussing the devil-in-the-details can undermine the task of building support for a policy goal. 'Have your cake and eat it' narratives are attractive and easier to sell – for politicians seeking votes, businesses seeking clients, or websites seeking clicks. This may have been part of what former New York Governor, Mario Cuomo, meant when he said that 'you campaign in poetry [but] govern in prose'.[80] So political strategists advise candidates to focus on ends rather than means, to adopt simpler, positive narratives and to avoid uncomfortable truths.[81] That idea may be part of the plan to develop and sell the Green New Deal, which articulates a vision of a desirable future state in which these energy tradeoffs have (somehow) been addressed or resolved.[82]

This strategy seems premised on the idea that the articulation of an inspiring message can generate congressional majorities in support of wholesale change – a premise that seems far from evidently true. It seems just as likely that future left-of-centre majorities in Congress will include a healthy representation of moderate Democrats whose agreement will be required to address climate change

[77] David Karpf, *Analytic activism: Digital listening and the new political strategy* (Oxford University Press, 2016).

[78] 'Political Polarization in the American Public' (*Pew Research Center*, 12 June 2014), available at www.people-press.org/2014/06/12/section-1-growing-ideological-consistency/#interactive; See also, GC Layman et al, 'Activists and Conflict Extension in American Party Politics' (2010) 104 *American Political Science Review* 324–27 (describing how party activists play a leading role in moving party rank-and-file away from the ideological middle and toward the poles – a process the authors call 'conflict extension').

[79] Z Hirji, 'Republicans Plan to Wage War against the Green New Deal in 2020' (*Buzzfeed*, 13 February 2019), available at www.buzzfeednews.com/article/zahrahirji/republicans-green-new-deal-2020-elections.

[80] E Kolbert, 'Postcript: Mario Cuomo (1935-2015)' (*The New Yorker*, 1 January 2015), available at www.newyorker.com/news/news-desk/postscript-mario-cuomo.

[81] A Burns, 'Pete Buttigiegs Focus: Storytelling First. Policy Details Later' *The New York Times*, 14 April 2019, available at www.nytimes.com/2019/04/14/us/politics/pete-buttigieg-2020-writing-message.html.

[82] D Roberts, 'The Green New Deal, Explained' (*Vox*, 30 March 2019), available at www.vox.com/energy-and-environment/2018/12/21/18144138/green-new-deal-alexandria-ocasio-cortez.

effectively. In the so-called 'blue wave' election of 2018 (so named because many Democrats supplanted Republicans in the House of Representatives, and also because Democrats in the United States are associated with the colour blue), both moderate Democrats and progressive Democrats claimed victories, but more seats were transferred from Republican to Democrat hands by moderates. As of this writing (2019), among the 235 Democrats in the House of Representatives, 101 are members of the moderate 'New Democrat' caucus, and 95 are members of the Progressive Caucus. There has been tension between the groups over the green transition, with some progressives denouncing moderate Democrats on social media for their failure to support the Green New Deal.[83] The two sides seem to be pursuing separate agendas, with moderates pursuing a climate agenda comprising market-friendly measures that might claim some bipartisan support,[84] and progressives eschewing those kinds of measures as insufficient and endorsing the kind of government-centric redesign of energy markets represented by the Green New Deal.

IV. Conclusion

Regardless of whether the political logic of avoiding discussion of tradeoffs is correct, the question of how best to reach the shared goal of a greener energy mix ought to be debated. As described above, a rapid green transition entails thorny value choices about how to allocate the cost and responsibility for ensuring a reliable energy supply. Increased reliance on wind and solar power will force choices about how to ensure that the lights stay on when the wind and sun are unavailable. Who will make those investments? Who will pay for them ultimately? Should individual consumers bear more responsibility for ensuring (and paying for) a reliable supply of energy, or is this a collective project? How will Democrats, Republicans, liberals, and conservatives come to a consensus (or a durable majority view) on the need to reduce carbon emissions sharply and quickly, and the means to accomplish that task? How will choices about how to manage these reliably and cost tradeoffs figure into that process?

Presumably, a full, public exposition of these issues will promote a better understanding of the truth about these tradeoffs, and a better and more coherent policy response to them in the end. In a hyper-polarised American polity, however, grappling honestly with difficult tradeoffs is uncomfortable. When the politics of a policy discussion are fraught or emotionally-charged, facing the inconvenient

[83] H Caygle and S Ferris, 'Do Not Tweet: Pelosi Scolds Progressives in Closed-Door Meeting' (*Politico*, 10 July 2019), available at www.politico.com/story/2019/07/10/pelosi-progressives-twitter-1405763.

[84] JE Peters, 'Rep. Scott Peters Releases "Climate Playbook" as alternative to Green New Deal' *The San Diego Tribune*, 10 April 2019, available at www.sandiegouniontribune.com/news/environment/story/2019-04-10/rep-scott-peters-releases-climate-playbook-as-alternative-to-green-new-deal.

truths associated with the issue is more difficult for all concerned. Social media amplify these problems. The kinds of insulated, parallel narratives that arise in online communities may persuade community members, but they only *educate* those audiences when competing narratives intersect in ways that engage the other's assumptions and arguments fairly. That seems to happen only infrequently in online communities.

Perhaps the energy policy debate in the United States will mature into something more than competing, simple narratives. Maybe the costs of climate change will drive even Republican voters to insist on a national climate policy. Perhaps businesses will add their voice to that chorus, driven by the desire to avoid the costs of climate change in their operations. Perhaps a critical mass of Republicans in Congress will join the vast majority of Democrats in crafting a national green energy transition policy. Perhaps not. Absent a policy push, in more traditionally regulated electricity markets, IOUs continue to earn a return on their fossil-fuelled generators, insulating them from competition from cheaper renewables and slowing the transition to a greener energy mix. In the competitive parts of the American electricity sector, the market will continue to favour inexpensive, zero-marginal cost wind and solar generators for at least as long as new entrants can be assured of selling all the power they can generate to customers. That process will continue to reduce the carbon intensity of the American electric grid for some time. But progress beyond that point will require a policy push. That, in turn, will require policymakers to face the distributional questions described in this chapter, which will be difficult in the polarised, fragmented policy environment that currently dominates American energy politics.