Ensuring Technical Competency for Management of Research-Focused Organizations

Abstract

Does a national research-focused organization need a technically competent leader? This study provides preliminary answers to that question using a natural experiment underway at the Department of Energy (DOE): a leader with significant high-level management experience superior to that of his predecessors, but no relevant technical experience was appointed to run the vast scientific research operation. The following hypothesis is proposed: A major risk of allowing technically-unqualified leadership is that an amateur can be more easily manipulated by special interests against the best interests of the nation. The hypothesis is tested by technically analyzing three case studies on proposals from the Secretary of Energy. The results show 1) requests for budget cuts undermining DOE's mission, 2) requests for redundant studies wasting DOE resources, and 3) counter-productive recommendations derived from a misrepresentation of the studies' results, which indicate technical competence is important for DOE leadership. These preliminary results indicate technical competency is important for leaders running organizations that oversee research. Finally, a potential policy safe guard to the risks of extreme technical incompetence is provided, which can be applied to either independent- or politically-appointed bureaucrats.

Keywords: political appointments; bureaucrats; technical competence; research organization; leadership; management

Introduction

Political science has had more than a 40-year-old debate to determine if independent bureaucrats (Heclo, 1975; Gilmour & Lewis, 2006; Krause et al., 2006) or politicized appointed bureaucrats (Moe, 1985; Bok, 2003; Bilmes & Neal, 2003) are better for governance. Several benefits of political appointees have been described including: i) providing more loyalty thus preventing the President from having to bend the rules to reach goals (Moe, 1985), ii) keeping government in touch with goals of interest groups (Bok, 2003), and iii) expanding risk taking while supporting an entrepreneurial environment (Bilmes & Neal, 2003). Despite these potential benefits, it has been more convincingly argued that American presidents should seek neutral competence (objective bureaucratic expertise) by hiring career professionals instead of political appointees (Heclo, 1975; Gilmour & Lewis, 2006; Krause et al., 2006). This is because long-time non-appointed agency personnel are more likely to possess specialized policy expertise, meaningful experience, public management skills, and have existing relationships with key stakeholders (Heclo, 1975). Stated simply, the more politicized an appointment is, the less likely to be competent (NCPS, 2003). Political appointments create more turnover than civil service or merit systems, hurt recruitment of highly qualified personnel and lack effectiveness in meeting policy objectives (Hugh, 1977; Mackenzie, 1987; Ban & Ingraham, 1990; Suleiman, 2003). There has also been new substantial empirical research that shows that U.S. federal programs run by career managers demonstrate systematically higher management grades than programs administered by political appointees (Gilmour & Lewis, 2006; Lewis, 2007). Numerous studies over the last twenty years support this "careerist's premium" (Fields, et al., 1997; Aberach & Rockman, 2000; National Commission on the Public Service, 2003; Huber & McCarty, 2004; Lewis, 2007; Gailmard &

Patty, 2007; Gallo & Lewis, 2011; Hollibaugh, et al., 2014). This can in part be because of their higher probability of maintaining professional objectivity and unwillingness to abdicate their professional judgment in response to special interests (Rourke, 1992). Although it should be pointed out that data from Korea that the well-established careerists' premium may also be in part due to lobbying, the revolving door phenomenon and regulatory capture (Hong & Kim, 2017) and other studies have found none in the case of school superintendents (Partridge and Sass, 2011).

In the early 2000's it was claimed that the performance gap between political appointees and careerists was decreasing due to better education and more prior government experience for political appointees (Aberbach & Rockman 2000, Donahue, 2003). Lewis found that these appointments still did not do as well as careerists even though the average political appointees had higher education levels, more management experience, and more varied work experience (Lewis 2007). Thus, it would be concluded at that point in American history it was still better to utilize careerists for bureaucratic posts, although if using highly educated and experienced political appointments (particularly within the government system) the variance might be minimized to gain the benefits of politicized appointed bureaucrats such as increased loyalty.

Then in 2016, the President of the United States was elected (U. S. Electoral College, 2016) as an inexperienced political outsider (e.g. the first U.S. president to have had no experience in government or military command before the Presidency (Page & Heath, 2016)). The 45th U.S. President's strategy for appointments was also far different than his predecessors; with his administration leaving an unusually high number of political appointments vacant (Yourish & Aisch, 2017). In addition, much like the 45th President, many of his appointments were unqualified by historical standards (e.g. Talley a lawyer who had never tried a case was nominated for a federal judgeship (Phillips, 2017) or the lobbyist DeVos, who is not an educator nor a technical expert in pedagogy, curriculum or school governance was nominated to run the Department of Education (Henderson, 2016)). Many of these nominations were not confirmed by vote (or as in the case of Talley withdrawn), but some did obtain some of the highest positions within the U.S. government like DeVos, the current (April 2018) Secretary of Education. This includes some of the more technical sectors of administration, which have previously been assumed to necessitate a technically-competent administrator (regardless of careerist or appointment by any political party).

This novel nomination strategy, thus provides a new opportunity to probe the hypothesis that executive skills are far more important than engineering or scientific prowess when governing large federal research labs. As many of the CEOs in the business sector come from non-technical backgrounds, it is commonly believed that intellectual curiosity, reasonable intelligence, good work ethic, and eagerness to learn are all characteristics of a good manager that have nothing to do with technical competency. Gottesman and Morey (2010), for example, show no significant evidence that the type or selectivity of the education of the CEO is related to firm financial performance. Can this thinking hold true for national organizations like research organizations run by political appointments? More specifically, do research-focused organizations need a technically competent leader?

This article attempts to provide preliminary answers to these questions using case studies, of perhaps the most extreme case possible: a technically-unqualified manager with significant high-level management experience being appointed to run the vast scientific research operation of the Department of Energy (DOE). First, this article will provide a brief introduction to the DOE and its responsibilities. Next, Rick Perry's technical background relevant to lead the DOE will be summarized and compared to the past three Secretaries of Energy (to provide protection against political bias by providing examples from Republican and Democratic administrations). Then a natural experiment will be performed to test the following hypothesis: A major risk of allowing technically unqualified leadership is that an amateur in any given field can be more easily manipulated by special interests to provide policies against the best interests of the nation. This hypothesis will be tested by analyzing from a purely technical perspective the major policy efforts put forth by Secretary Perry to alter the DOE's budget and alter the electricity to market to reach technical goals. Finally, this article provides a potential policy safe guard to the risks of extreme technical incompetence, which can be applied to either independent or politicized appointed bureaucrats.

Background on the Department of Energy

The U.S. DOE is a vast scientific research operation that covers all areas of energy generation and conservation. It also specifically covers energy and safety in handling nuclear material. The DOE supervises the nuclear weapons program, nuclear reactor production for the United States Navy, and radioactive waste disposal. The DOE is a major sponsor of research in the physical sciences, the majority of which is conducted through a system of seventeen elite National Laboratories. The DOE research activities are distributed among domestic energy systems, defense (through their National Nuclear Security Administration), and general science (through their Office of Science). The DOE has a budget request of \$32.5 billion for FY 2017 (DOE, 2016) a substantial part of this is to help pay the \$348 billion needed for the nuclear weapons program over a decade (Mehta, 2015). The DOE employs about 14,500 people directly – many of them scientists and engineers working in various energy fields. Most of them work for one of the 17 flagship national labs: Ames Laboratory, Argonne National Laboratory, Brookhaven National Laboratory, Fermi National Accelerator Laboratory, Idaho National Laboratory, Lawrence Berkeley National Laboratory, Lawrence Livermore National Laboratory, Los Alamos National Laboratory, National Energy Technology Laboratory, National Renewable Energy Laboratory, Oak Ridge National Laboratory, Pacific Northwest National Laboratory, Princeton Plasma Physics Laboratory, Sandia National Laboratories, Savannah River National Laboratory, SLAC National Accelerator Laboratory and the Thomas Jefferson National Accelerator Facility. The DOE also oversees the Advanced Research Projects Agency-Energy (ARPA-E) an agency tasked with promoting and funding research and development of advanced energy technologies (similar in mission to DARPA, but for energy). The DOE laboratories as a whole comprise a preeminent federal research system, providing the United States with strategic scientific and technological capabilities. These labs are well known for having developed many innovations that have benefited the American economy as well as national security.

Technical Competence of the Secretary of Energy

Rick Perry is the current (April 2018) Secretary of Energy, having been voted in by the Senate 62 to 37, split largely on party lines (Reuters, 2017). Secretary Perry, has considerable government and administrative experience working as a representative in Texas in 1984, as Agricultural Commissioner from 1990 until he became Lieutenant Governor in 1998 and then governor of Texas from 2000 to 2015, making him the longest-serving governor in its history. His upper-level government and management experience was established and respected enough that for a time many believed he had a high probability of becoming President of the U.S. himself (Hechtokpf, 2012). **Thus, it is objectively clear, Perry is well qualified for executive leadership in government because of his substantial experience.** This experience in executive leadership in government has been argued to be explain how Perry has maintained his position in a Cabinet with high turnover rate (Adragna, 2018).

Despite Perry's superior executive leadership skills and experience, his energy-related technical background is objectively lacking. He has a B.S. degree from Texas A&M in animal science, which does not provide technical background in any form of energy research (fossil fuel, nuclear, renewable, efficiency or basic science). Following an exhaustive search using Scopus (Elsevier's abstract and citation database), no peer-reviewed publications appear to have been published by Rick Perry including no papers, articles or books on any area in the energy or nuclear energy/weapons fields. This training and lack of interest and participation in the energy field indicate that Mr. Perry does not have the technical background to make informed decisions about energy research and policy. **It can thus, be concluded that Rick Perry does not have technical competence in areas relevant to the DOE.**

To understand how grossly unprepared Mr. Perry is from a technical standpoint (as well as guard against partisanship) it is necessary to go back a dozen years to compare his preparation to former appointees from both Democrat and Republican Presidents.

First, Dr. Samuel Wright Bodman III, a republican, was appointed the 11th U.S. Secretary of Energy by President George W. Bush. Dr. Bodman is a chemical engineer with a B.S. from Cornell University and Ph.D. from MIT. He then worked as a professor in the energy field at MIT. He also had significant industry experience relevant to the DOE such as serving as Executive Officer at Thermo Fisher Scientific, Inc. and as a Director of Thermo Electron Corporation (Bloomberg, 2018).

Dr. Bodman was replaced by Dr. Steven Chu (Energy.gov, 2018) appointed by President Obama (a democrat). Dr. Chu received both a B.A. in mathematics and a B.S. in physics from the University of Rochester and a Ph.D. in physics from the University of California, Berkeley. He then went on to work at Bell Labs and Stanford and eventually Lawrence Berkeley National Laboratory, a U.S. Department of Energy National Laboratory, and joined UC Berkeley. He has won a long list of awards and honorary PhDs related to his prolific research and even won the Nobel prize in physics.

Dr. Chu was replaced by Dr. Ernest Moniz a nuclear physicist with a BS *summa cum laude* in physics from Boston College and his PhD in theoretical physics from Stanford University. He worked at the Physics Department head at MIT. Dr. Moniz was the founding Director of the MIT Energy Initiative. He was also the Director of the MIT Laboratory for Energy and the Environment where he was a leader of multidisciplinary technology and policy studies (Energy.gov, 2018).

Doctors Bodman, Chu and Moniz regardless of their party affiliation all share

an elite education, deep and long technical experience in energy as well as leadership, respect from their technically-trained colleagues, and a well-acknowledged internationally-recognized expertise in the energy field. All three could easily get any number of technical positions in any of the DOE's elite labs. None of this can be said about Perry the current Secretary of Energy, who has superior administrative experience, yet no relevant technical background. **This makes the results of Secretary Perry's leaderships of the DOE a nearly perfect natural experiment¹ to test if executive skills are more important than engineering or scientific prowess when governing large federal research labs.**

Why Technical Competency Matters

It is intuitively obvious that appointing someone over an organization primarily made up of scientists and engineers in a particular field that does not have the capacity to understand or guide their work is not a good idea, however, managers of any type of organization can be more easily manipulated if they are ignorant of the technical aspects of the position. While leaders are generally functionally literate and normally have a university education, they may not be literate in the technical aspects, which render them as easily controlled as a uniformed population (Herman & Chomsky, 2010). However, the theories supporting politicized appointed bureaucrats demands that there is no harm (or at least the benefits outweigh the harm). In this case, where energy is such a critical infrastructure (Robinson, 2015) both for national security (Prehoda et al., 2017) and economic health (Stern, 2004) it is clear that the selection of the Secretary of Energy is important for the best interest of the nation. Even for less important bureaucracies it is important that the leadership understands the technologies for which they are making decisions. Critics may argue that if an administrator hires managers with technical expertise it is not necessary that the administrator understands technical information. However, there is a minimum level of competency necessary to be able to understand the advice and data being provided from the technically competent managers below in order to make informed decisions. Thus for those that do not have the background to understand the information they must rely entirely on outside perspectives and are thus more susceptible to manipulation and control by special interests.

It is hypothesized that one of the greatest risks of allowing unqualified leadership is that an amateur in any given field can be more easily manipulated by special interests to provide policies against the best interests of the nation. Is this currently occurring with Secretary Perry? In this case there are various interests that stand to gain significantly from manipulation of U.S. energy policy including various energy industries and mining associated with these industries. These industries want specific policies to improve their own competitiveness and profitability, while the general public and non-energy related businesses and industry want reliable electric power at the lowest costs (both economic and externalities). Three of Secretary Perry's major acts while in office to date will be analyzed in detail to determine the answer to that question: 1) Perry's DOE budget request (DOE, 2018), 2) Perry's request for a grid reliability study (Perry, 2017a) and 3) Perry's policy

¹ Here the term natural experiment is used to describe an empirical study in which the Secretary of Energy position is exposed to the experimental conditions as determined by nature (other factors outside the control of the investigators) (Dunning, 2012), Why Mr. Perry was chosen to head the DOE is not important for the purposes of this study. What is important is that he has an extreme level of administrative experience and no technical experience. It is only a "nearly" perfect natural experiment because there are other factors outside of observable control that could influence the results and are discussed in the Limitations section below.

recommendation for direct subsidization of economically uncompetitive coal and nuclear power plants (Perry, 2017b).

Case 1: Proposing to reduce the DOE budget for energy reliability and eliminate all advanced energy research

The first Department of Energy's Budget request to Congress under Perry's leadership (DOE, 2018) was counter to the goals of U.S. energy research for four reasons, but only the last two reasons will be analyzed as the first two can be obfuscated by political partisanship. First, it decreased the overall budget for the DOE. The DOE requested \$28 billion for fiscal year 2018, was a reduction of \$1.6 billion from the FY16 enacted level of \$29.6 billion. In general, it is widely agreed that more funding benefits of the mission of a given organization. The DOE budget has historically fluctuated from year to year based on funding priorities. Thus, the decrease for Perry's first DOE budget proposal will not be used in the analysis. Second, the proposal would cut funding for the Office of Energy Efficiency and Renewable Energy (EERE) by 70%, from \$2.1 billion to \$636 million. This massive cut was proposed as renewable energy was by far the most significant growing energy source in the U.S. (with the reduced levelized cost of electricity of solar (Branker, et al., 2011) alone driving a massive increase in U.S. solar installations (SEIA, 2018) and 2/3rds of the growth in the U.S. (Associated Press, 2017)). As government support for particular energy technologies has become highly partisan this proposed cut will also not be used in the analysis here. Third, despite prioritizing energy reliability (as discussed in Case Study 2 and 3 below), Perry requested cuts to the Office of Electricity Delivery and Energy Reliability by over 40% (it would be reduced to \$120 million, down \$86 million from the FY16 enacted funding level of \$206 million), specifically targeting smart grid, cybersecurity, and energy storage programs (Hand, 2017). Thus the DOE's funding for the Office of Electricity Delivery and Energy Reliability would decrease while Perry claimed this was America's top priority in energy as discussed below in the next two case studies. Lastly, Perry's proposed budget would completely terminate the Advanced Research Projects Agency-Energy (ARPA-E), which researches all forms of energy. As this is non-partisan in nature and would impact the mission of the DOE, this final proposed budget cut will be used for analysis in case study 1.

ARPA-E was founded by President George W. Bush (a Republican) as it was signed into law in the America COMPETES Act (2007). Bush was acting on advice from the National Academy of Sciences, National Academy of Engineering, and Institute of Medicine in their report *Rising Above the Gathering Storm: Energizing and Employing America for a Brighter Economic Future* (2007). The National Academies warned policymakers that U.S. advantages in science and technology, which made the country a world leader, had already begun to erode and advised establishing ARPA-E to be modeled after the successful Defense Advanced Research Projects Agency (DARPA) program. ARPA-E project funding has similarly been highly successful: 71 projects have formed new companies, 136 project teams have raised more than \$2.6 billion in private-sector follow-on funding to continue to advance their technologies toward the market, 1,634 peer-reviewed journal articles providing public domain knowledge to build future products upon and 248 patents were issued as of February 2018 by the U.S. Patent and Trademark Office (ARPA-E, 2018). In all areas of energy research it is widely regarded that these indicators demonstrate that ARPA-E's focus on early-stage energy research advances America's state of the art in energy science and engineering while providing new opportunities for commercialization of advanced energy technologies. It is obvious that completely eliminating the program is counter to the best interests of the nation as no follow on study to *Rising Above the Gathering Storm*, from the National

Academies has shown that energy research is no longer critical to U.S. interests. Thus, former Republican officials, oil executives and business leaders of both fossil fuel and clean energy technologies all warned Congress and Energy Secretary Rick Perry that his proposed budget cuts would have a devastating impact on national security and the economy (Marshall, 2017). Congresses finalized budget in 2018 maintained the existence of ARPA-E (Guess, 2018), but again the proposed budget from Perry for 2019 eliminates it (OMB, 2018).

Case 2: Commissioning a study, whose results were well known in the field

In an April 14, 2017 memorandum, Secretary Perry called for a review of electricity markets and reliability (Perry, 2017a) and demanded a rushed study to be published 60 days from April 19, 2017. His rationale of the review was to examine whether baseload power plants (primarily coal and nuclear power plants) are being unfairly pushed off the grid by renewable energy technologies, which in his opinion may threaten energy security and reliability (Perry, 2017a). Perry assumed that “Baseload power is necessary to a well-functioning electric grid.” (Perry, 2017a), which is far from well-established fact with modern power technologies. This is because the more solar and wind (variable power sources) that are on the grid, the less constant base load is needed and the more flexible sources of dispatchable power are necessary. Many energy analysts felt the entire study was a fundamentally-flawed and thinly disguised attempt to revive the failing coal industry (Cama, 2017; Davidson, et al., 2017; Dlouhy & Jacobs, 2017; Roberts, 2017).

To place this study in context it should be pointed out that Perry was appointed by a President, who campaigned on a platform of reviving the coal industry (Grunwald, 2017). There was a seeming need to revive the dying coal industry because profitability for U.S. coal-fired power plants has been declining and dropped radically since 2007 driving a steep cut in coal plants (EIA, 2018). These trends are expected to continue (EIA, 2018). For example, the U.S. Energy Information Administration notes that between 2010 and 2012, 14 gigawatts (GW) of coal-fired capacity was retired and that a total of 60 GW will be retired by 2020 (EIA, 2018). Coal mines close causing coal miners to struggle (Krauss, 2015) and one major coal company (like Arch) after another (like Peabody Energy the world’s largest private sector coal company) has filed for bankruptcy (Miller & Brickley, 2016; Miller & Jarzemsky, 2016). Coal workers have been left with mortgages on houses with few buyers in blighted coal country (McGreal, 2015). It is clear that coal is no longer a competitive form of electrical generation (Storow, 2017). In addition studies have been done to find a way to transition coal workers to other employment in the energy industry like the rapidly growing solar sector (Louie & Pearce, 2016), which added more new jobs to the U.S. economy last year than the entirety of existing coal mining industry.

The first major flaw in the study is that it had already been done several years earlier in 2012 by the DOE’s own National Renewable Energy Lab (Hand et al., 2012). The *Renewable Electricity Futures Study*, found that the U.S. could accommodate up to 80% renewable energy using existing technology, with no loss of reliability (Hand et al., 2012). For context, in 2016 the EIA reports the U.S. only uses 15% renewable energy-generated electricity. Other studies have found even a greater potential contribution percentage from renewable energy technologies with no adverse effects (Van Horn, et al., 2017). Rather than use the previous reports or utilize any of the major institutional energy centers, Perry appointed an economist (thus again technically unfit to lead the study) from the Institute of Energy Research, which is a group funded by the fossil fuel industry (Goldenberg & Bengtsson, 2016). The subsequent report (DOE, 2017a) was largely free from political interference in part because someone at the DOE leaked a draft of the report, which made

political interference easy to determine (Roberts, 2017b). Although the language in the summary was political, the bottom line of the DOE analysis, however, is there is no technical reason to protect coal or nuclear plants from economic retirement (DOE, 2017a), which undermined Perry's reason for commissioning the study (Roberts, 2017b).

Case 3: Making policy recommendations, inconsistent with all studies on grid reliability

Despite the results of the study from Case 2, Perry then issued policy guidelines based on the reasoning for the study – not on the outcome of the study – when he called for massive new subsidies for coal and nuclear plants to support grid reliability (Perry, 2017b). Perry's notice of proposed rulemaking (NOPR) (DOE, 2017b) called for the independent Federal Energy Regulatory Commission (FERC), to adopt new regulations that would ensure coal and nuclear plants can “[recover] fully allocated costs and thereby continue to provide the energy security on which our nation relies.” This rule would protect coal and nuclear plants from the price competition of renewable energy sources as well as natural gas (Mufson & Mooney, 2017). The rule was widely ridiculed among energy analysts for likely highly inflating costs for electricity, including Jon Wellinghoff, who chaired the Federal Energy Regulatory Commission under republican President George W. Bush (Bade, 2017). The increase in electric utility rates for consumers if the NOPR from Secretary Perry was instituted was estimated to be from \$800m to about \$4 billion/year (ICF, 2017) and could even climb up to \$11.8 billion/year (Orvis, et al., 2017). There is obviously uncertainty in the cost of the NOPR, but the general consensus was that it would have created substantially higher electricity costs for consumers.

Having onsite “fuel assurance” (the key benefit of coal and nuclear needing the NOPR) has no impact on grid reliability (Roberts, 2017c), which according to the North American Electric Reliability Corporation (NERC, 2017a; 2017b) is actually both already good and improving. These NERC studies, made by the technical authority on grid reliability, directly undermine the core of Perry's argument. Incidentally, the NERC reports were no different than the conclusion in Mr. Perry's own DOE study (DOE, 2017a). Houser et al., point out that the fuel supply problems Perry's proposal seeks to solve with the NOPR represents only 0.00007% of all the major power disruptions, nation-wide over the past five years (2017). Thus, as Orvis and O'Boyle show, Perry's proposed rulemaking threatens to destroy wholesale markets and raise costs with no tangible benefit (2017).

Unsurprisingly, the largest U.S. grid operators opposed the plan (Traywick, 2017) as did all of the non-coal/nuclear technical industries (e.g. natural gas producers and renewable energy industries including the solar and wind industries), who argued it would undermine free-market competition in wholesale power markets. In addition, with increased costs for electricity with Perry's proposed plan and the existence of lower-cost distributed generation hybrid systems made up of solar photovoltaics, batteries and/or cogeneration using natural gas (Shah et al., 2015; Mundada, et al., 2016) the rule could instigate mass-grid defection (Bronski, et al., 2014; Kantamneni, et al., 2016). This risks creating a “utility death spiral”, where as customers leave the grid, utilities sell less electricity and have to raise prices to cover their fixed costs on their existing customers. This improves the economics for existing customers to grid defect creating a positive feedback loop, which increases electricity prices further and drives more electricity customers off grid. All of this would have further reduced grid reliability. Fortunately, for the continued functioning of the U.S. electric grid, FERC rejected Perry's plan (Traywick and Natter, 2018).

Results: Perry's Technical Abilities to be the Secretary of Energy

Readers are instructed to set aside their personal views on Perry's politics and the unfortunate time he forgot the name of the Department he pledged to eliminate and now ironically heads (Smith, 2016). Instead, focus only on Mr. Perry's preparation and technical competence in any area of the broad energy field or nuclear weapons. Unfortunately, as the results of the three case studies make clear, Rick Perry's education and prior interests have not prepared him to lead the DOE. The misguided attempt to repeatedly eliminate America's advanced energy research in its entirety (case 1) and the confines of both Perry's grid security study (case 2) and the recommendations derived from a misrepresentation of the results in the NOPR (case 3) are guided by an ignorant understanding of the technical and economic realities of the U.S. electric system and were clearly impacted by special interests of the owners of now obsolete technologies (coal and nuclear power plants and the concomitant mining interests of coal and uranium). For any DOE Secretary to allow special interests to make the electric system both more expensive and more vulnerable is clearly not in the best interests of the nation. Thus although the policies that Secretary Perry tried to institute would have weakened the technical abilities and energy leadership in the U.S. in the future (as shown in case study 1) as well as increased the costs for consumers of electricity (as shown in case study 3 because of misinterpreting the results of case study 2), he was unsuccessful because of the checks and balances offered by Congress and FERC, respectively.

How can the U.S. political system be protected from unqualified political appointees in the future?

The Solution to Technically-Unqualified Appointments: Objective Technical Exams

Care must be taken when defining technical competence. It is easy to have one's judgment clouded by partisan politics. The increasing rate of political polarization in the U.S. (Gerber & Schickler, 2017; Jasney, 2017; Tozzo, 2018) has created an environment in Washington that demands party loyalty (and in some cases personal loyalty) (Pfiffner, 2017) over the best interests of the nation. There is an unprecedented polarization of the American people on a number of issues (e.g. nativism (Huber, 2016), racism (Luttig et al., 2017), sexism (Darweesh & Abdullah, 2016), and science/anti-science (Reardon, 2017) and alternative facts, post-truths (Journell, 2017) and lies (Leonhardt & Thompson, 2017; Beckwith, 2018)).

In the past, the Congressional approval of Presidential appointments provided a safe guard against unqualified appointments at the highest levels of government. The representatives that voted for Perry's appointment were under considerable political pressure despite his lack of technical preparation. They should never have been put in that position. To avoid having a partisan Congress voting for technically unqualified candidates in the future, here a proposal is made for a basic competency test for all political appointees. To avoid partisanship and extra bureaucratic waste the competency test should be administered by existing neutral institutions in a fair and transparent way.

The proposal here is that a basic technical competency test for the specific discipline would be administered by a randomly selected top-ranked American university offering a class in the discipline of the appointment. A Senate chair of the appropriate committee would use a random number generator (Marsaglia, et al., 1990) to select a single

value from 1-100 and then the subsequent currently ranked school listed in the U.S. News and World Report (2018). The nationally ranked (and accredited) university chosen would have the current instructor for the representative course provide the course's final exam and solutions key to the senate. The exam would be administered to the political appointee by the senate committee, while being openly filmed and published by the media and then would be openly graded against a pre-made solution sheet. Passing the test would ensure a basic level of competency for the political appointees, while also providing a barrier to entry for unqualified individuals to even submit their names for appointments.

So, for example, a graduate level energy survey course would be used to ensure that a proposed Energy Secretary was technically competent to lead such an important and valuable government Department. Similar tests could be administered for the Secretary of Education in the education field, space science for NASA and so on. This type of test would be non-partisan and objective and ensure that nation were not subjected to technically incompetent political appointees in the future. In addition, such a test would provide a potential policy safe guard to the risks of extreme technical incompetence for both independent or politicized appointed bureaucrats.

Limitations

There are other potential possibilities that restrict this from being a perfect natural experiment. For example, critics of the Secretary could claim that the manipulation is caused by his political career (e.g. compromises with special interests could be a long standing political tactic used by the Secretary to garner campaign contributions).² Although this is certainly possible, it is instructive to look at the data available. The decisions made while Secretary of Energy stood to most benefit coal-related industries and nuclear power related industries to the detriment of the renewable energy and natural gas industries. Yet, Open Secrets report that for the 2016 presidential election Perry's campaign contribution support was dominated by the oil and gas industry (2018), not coal or nuclear. There are other potential explanations for which there is no evidence such as coal interests could have funneled money through other areas or threatened/blackmailed the Secretary or his family with physical violence, spreading compromising information, etc. Regardless of the reason for the manipulation, it is clear there were better (technical) methods for obtaining the same goals indicated by his actions. So for example, if the goal was to increase coal utilization in a technically efficient way, the DOE could have instituted policies that encourage cogeneration³ at America's coal-fired electricity plants and the same idea would improve nuclear energy's performance (Pearce, 2012). Lastly, Secretary Perry may have different goals than those he stated publically. So, for example, he could have either lied or been acting as a foreign agent when he claimed to want to increase U.S. grid reliability. Again, while this is possible and the ties between the current administration and Russia appear to be substantial, there have been no reported ties between Russia and Mr. Perry (Joseph, 2018). Thus although there are other potential explanations, the evidence available implies that the lack of technical competence was the primary explanation of the poor performance of the Secretary of Energy.

² Here his political career was necessary as it was used for this natural experiment because it provided a long and distinguished administrative career.

³ Cogeneration enables the production of heat as well as electricity at power plants. This can increase the percent of energy recovered from coal substantially. It is a relatively common practice to take advantage of such cogeneration (cogen or combined heat and power (CHP)) plants in Europe (Bartnik & Buryn, 2011), but is largely not practiced in the U.S.

Conclusions

The results of this preliminary study indicate the hypothesis is true: even the most experienced executives if technically unqualified are a risk to national interests as they are more easily manipulated by special interests to provide policies against the best interests of the nation as a whole. To protect the nation and provide a potential policy safe guard even in times of extreme partisanship, a low-cost bureaucratically-expedient method has been proposed to eliminate the risks of extreme technical incompetence. These objective technical tests can be applied to ensure technical competence for both independent and politicized appointed bureaucrats.

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