Narrative futures and the governance of energy transitions

Clark A. Miller *, Jason O'Leary, Elisabeth Graffy, Ellen B. Stechel, Gary Dirks

Arizona State University, United States

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ABSTRACT

Today's societies confront an enormous challenge with regard to governing complex energy systems change. We argue that futures approaches based on narrative strategies that encourage individual and collective storytelling and meaning construction offer a valuable tool for enhancing societal capacity to meet this and similar governance challenges. We report on a two-day scenario planning exercise that sought to implement and test these ideas. The exercise involved a diverse group of professionals in both energy and non-energy fields, with a question focused on the narrative construction and deliberation of scenarios about Arizona's energy future in 2050.

1. Introduction

Today's societies confront significant challenges with regard to legacy energy systems. These systems have deep societal significance, are entrenched in diverse social, economic, and political arrangements, and have evolved considerable complexity over many decades. They also need to undergo significant change. Interdependent physical and social infrastructure systems are increasingly vulnerable to the threat of climate change and need to be adapted to create greater resilience (Wilbanks, Bilello, Schmalzer, & Scott, 2012). Energy systems that depend on fossil fuels are rapidly altering the Earth's climate and must be fundamentally transformed to reduce global carbon emissions to sustainable levels (IEA, 2014b). Economic systems are increasingly driving disparity in incomes and wealth towards problematic levels that threaten core notions of equity and justice (Piketty, 2014).

Few communities worldwide currently have the capacity to confront these challenges and govern the transformation of complex legacy systems towards improved long-term outcomes. A growing body of scholarship demonstrates that futures research and practice have the potential to be important tools for enhancing this capacity (Robinson, 2003; VanWynsberghe, Moore, Tansey, & Carmichael, 2003). Futures methods can help facilitate effective strategic planning in the face of deep future uncertainties (Schwartz, 1992); they can motivate organizations to imagine and undertake transformative change (Brown, 2008; Emery & Purser, 1996); and they can contribute to the development of visions of desirable futures and to planning and assessing robust, analytically informed pathways for communities to progress towards these goals (Robinson, 1988). These and other forms of insight and inspiration that can be drawn from well-conducted futures exercises have the potential to help create a portfolio of capabilities that could help communities address the challenges they confront in managing transitions towards new energy futures.

Building on this scholarship, we argue that narrative is particularly salient in the development and application of futures approaches for tackling the problem of governing complex systems change. Our reasoning is partly theoretical, furthering

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* Corresponding author. Tel.: +1 4807278787.
E-mail address: clark.miller@asu.edu (C.A. Miller).

the work of recent studies that tie narrative strategies to both the problem of building social capacity for governing complex systems (Paschen & Ison, 2014) and to the development of new and innovative futures methods (Jarva, 2014). We also draw on insights from a collective experiment we conducted at the *Emerge* event at Arizona State University that explored the use of narrative methods in developing future scenarios of energy development. We use the term "experiment" here not in the strict scientific sense of a carefully controlled observational study but rather in the more general sense of exploration and empirical testing associated with action research in public deliberative spaces (Graffy, 2008). Our goal in conducting this exercise was to probe the potential value that narrative approaches might bring to thinking about the future of complex systems and to prototype potential tactics for using these methods in a domain like energy where more narrowly technical discourses and analytics have dominated research and policy but where social, economic, and political dynamics are likely to be increasingly significant in the context of complex systems transitions (Graffy & Kihm, 2014; Graffy, 2011a; Miller & Richter, 2014; Miller, Iles, & Jones, 2013; Miller, Richter, & O'Leary, 2015). *Emerge* offered a unique opportunity to test out our capacity to facilitate this new kind of conversation about energy in a convivial, supportive environment.

2. Energy systems change, futures research, and the importance of narrative

Over the next several decades, communities in the United States and across the globe face stark uncertainties and choices about how to produce, convert, and use energy in new ways, about whose voices will matter in shaping complex socio-energy transitions; and about who will benefit and lose from the resulting outcomes. Energy systems – the largest human enterprise on the globe – are in the midst of widespread transformation. Rising concerns about climate risks and dwindling supplies of conventional oil and gas have led businesses and governments to pursue myriad technological, economic, and regulatory innovations in energy systems, sometimes in diametrically opposite directions. Powerful beneficiaries of existing systems and those who seek benefit from new opportunities compete for influence. Major initiatives focus on unconventional fossil fuels production (including tar sands, hydraulic fracturing, and heavy crude), renewable electricity generation (primarily wind and solar energy projects, at a variety of scales), alternative fuels, energy efficiency, new models for nuclear energy, such as small modular reactors, and electrification of vehicles. These innovations promise to fundamentally alter the technologies, economics, and physical and social geographies of energy systems, reshaping not only where and how useful energy forms get generated and consumed but also the kinds of lived realities experienced by the people who inhabit future communities. Yet, the specific directions and outcomes of changes to energy systems remain deeply unclear, globally and in specific localities, even as to whether energy futures will be low or high in net carbon emissions.

In the context of large-scale systems transitions, in which organizations and communities confront stark uncertainties and complex choices, efforts to examine what the future may hold have the potential to carry weight and provide value. At Shell, for example, pioneering work that began in the 1960s on scenario planning methods helped the company anticipate and respond effectively to the new uncertainties created by the Arab oil embargoes of the 1970s (Shell, 2014a). Today, not surprisingly, energy futures work is widespread, with key reports commanding global attention, as communities at all scales seek to make sense of how new technologies and the threat of climate change may alter the energy systems of tomorrow. Major reports include Shell's New Lens scenarios (Shell, 2014b), the *World Energy Outlook* (IEA, 2014b), and various technology roadmaps by the International Atomic Energy Agency (IEA, 2013; IEA, 2014a), as well as national energy strategy exercises, such as *America's Energy Future*, by the US National Academy of Engineering (National Academy of Engineering, 2008).

As important as these efforts are in energy policy and planning, they fall short in two key ways. First, as has been noted elsewhere, the futures depicted in these reports are remarkably devoid of people (Miller, Richter, & O'Leary, 2015). The Shell scenarios, developed as they are with regard to anticipating the global macro trends that will shape energy futures, are the most expressive of these documents with regard to the people who will inhabit tomorrow's energy systems – yet they remain ten-thousand-foot flyovers, at best. The others barely reference people at all. Instead, they tell only the futures of technologies and fuels. Second, these efforts to engage the future are both produced by and oriented towards experts, whether in energy policy or the energy industry. They rarely engage a broader array of either participants in their production or, meaningfully, audiences in their use. This is not surprising. The energy sector has a long track record of technocratic decision-making, with limited opportunities for broader public engagement, often portraying energy choices to the public as relatively simple choices amongst fuels and technologies (Laird, 2013), rather than more comprehensive choices among competing socio-technological arrangements (Miller, Iles, & Jones, 2013). This reductionist view is exacerbated by administrative and regulatory processes that emphasize narrowly technological and economic formulations of energy policy to the neglect of the health, environmental, security, and justice dimensions of energy systems change (Graffy, 2011a).

In this article, we propose a narrative approach to energy futures as a potential means to strengthen effective public engagement and deliberation (Miller & Moore, 2011; Moore, 2013). Effective engagement of diverse participants from a range of backgrounds and with diverse levels and kinds of knowledge about energy systems can significantly enhance the ability of deliberative systems to fully incorporate the social, economic, environmental, and political implications of energy change into energy choices (Dryzek, 2010; Graffy, 2012). This is especially important in the context of large-scale energy transitions, where the non-technological and non-economic dimensions of energy policy may be particularly significant and where communities confront important limits in pursuing effective engagement other than via protest strategies. Emerging risks and social dislocations drive public concern (Miller, 2012). Social protests abound, surrounding every major form of proposed future energy development, including proposals to continue the status quo (Devine-Wright, 2011). Even so,

communities confront conflicting and contradictory uncertainties, opportunities, and risks. They often have limited experience with public engagement in the energy sector and limited access to credible information. Few tools exist for evaluating the social, economic, political, and environmental facets of energy choices, and incomplete and politically contextualized information may misrepresent available futures. There is a need, therefore, to develop new approaches that can facilitate a more productive, less confrontational dialogue between energy experts, policy-makers, and publics in which all feel able to participate meaningfully.

Narrative and storytelling are well positioned to accomplish the goals of facilitating improved engagement and decision-making among mixed groups that span not only traditional participants in energy policy but also an interested array of more diverse participants and overcoming the blinders inherent in legacy energy discourse and achieving greater integration of technical and social facts and values as futures are being deliberated and acted upon. The underlying motivation for using narrative approaches is relatively simple and well-rehearsed in the scenario planning community (Jarva, 2014). Stories and narratives are a principle form of human communication and, hence, not only something that diverse, broad publics can internalize but also a form of communication that readily permits the incorporation of contributions from many different groups of people to build collective frames of reference. In this regard, we define narrative approaches following Paschen and Ison, emphasizing that narrative is not merely about the genre or form of text produced – i.e., using written stories to describe scenarios, an approach used by many scenario planning projects – but also importantly about the act of telling stories as an integral element of the process (Paschen & Ison, 2014).

A narrative approach, following Paschen and Ison's definition, and as we use the term here, is one that focuses on strategies for helping individuals and groups find ways to construct and articulate meaningful stories about the current challenges they confront, potential ways of addressing those challenges, and what these may imply for themselves and the community as a whole. Narratives and stories allow people to connect social, economic, political, and technological elements together in ways that are meaningful to them (Barry, Ellis, & Robinson, 2008; Cronon, 1992; Nye, 1990; Ungar, 2000). Such stories allow people to imagine – and inhabit, in their minds – multiple, alternative visions of the future that may result from choices made today. Narratives enable people to envision future landscapes and communities, how people fit into and interact with them, and what those futures might mean for lives and livelihoods (Wolsink, 2007; van der Helm, 2009). By weaving in social elements, such stories show that what might otherwise appear to be technical issues have deep societal significance and thus expose complex socio-technological phenomena for public deliberation (Curran, 2012). Narratives are also social tools, helping coordinate and organize shared ideas as a basis for common futures (Cronon, 1992) and for exposing differences in values and beliefs. Crucially, multiple narratives typically exist regarding any salient issue, and distinct narratives tend to correspond to very different social constructions of the problem, public agendas and policy options (Graffy, 2006; Miller, 2000). Across multiple narratives, some elements inevitably contradict each other philosophically, while others can harmonize to create a variety of policy coalitions over time (Graffy, 2011b).

In the face of energy systems change, in particular, narratives offer an approach to communicative strategies and practices that can help promote broader engagement and participation in energy choices, more diverse kinds of policy information and input, and greater capacity to imagine and invent new energy futures. Narratives offer a linguistic currency that is accessible to everyone. They offer the common ground of community and memory. Narratives are not just stories, and narrative is not just storytelling. The stories people tell are rooted in cultural history and meaning and thus provide important touchstones that help anchor difficult conversations and deliberations. Narratives remind people of significant community values, even when not shared or similarly interpreted by everyone, and thus provide a relatively safe space for discussion. Perhaps most importantly, narratives provide an avenue for people to explain what is important to them and why it matters. Building energy deliberation and choice around narrative can, in this fashion, open up the conversation to participation by people who may not otherwise feel competent in 'energy speak', thus bringing to the fore a wider range of knowledge, insights, and perspectives and a deeper awareness of community values, identities, relationships, cultures, and histories (Wolsink, 2007). Narrative, if its potential is fully realized, not only creates more diverse and holistic visions of the future but also helps to legitimate them. Narrative can, in other words, as Paschen and Ison suggest, help enhance social learning and build social capacity for understanding and governing complex systems problems (Paschen & Ison, 2014).

3. The emerge experiment

To test whether these ideas could be formalized as design elements in a deliberation exercise, we organized a workshop, *Humanist Narratives of Energy*, as part of the 2012 *Emerge* conference at Arizona State University. *Emerge* was a 3-day gathering designed to create interdisciplinary spaces for artists, scientists, engineers, and others to collaborate and explore plausible futures. *Emerge* organizers sought to encourage the development of innovative and diverse methodologies and practices for envisioning futures that transcended conventional disciplinary approaches (see Selin, 2015). One of the three primary organizers of *Emerge*, Thanassis Rikakis, observed: "This is not a technocratic future, it is a future that balances humanist perspectives with technological and scientific perspectives" (Emerge, 2012).

As a form of inquiry designed to promote new ways of imagining and engaging collective human futures that meld the scientific, the technological, the artistic, and the social, the *Emerge* conference provided a congenial space for experimenting with new methods for enhancing narrative in deliberations of energy policy. As with the other *Emerge* workshops, the *Humanist Narratives of Energy* workshop served as a foresight laboratory, adapting traditional scenario planning modalities

to bring narrative approaches to the foreground. Our goals in this experiment – in the "action research" not "controlled laboratory" sense of the word – were three-fold. First, we sought to draw out and examine the variety of extant energy discourses and the manners in which they conflicted and converged. We wanted participants to feel that they had helped test an approach that could serve to productively advance broader, more insightful, and more collaborative deliberations about energy futures. Participants contributed to the scenario planning process through stories, in ways that allowed diverse narratives to emerge from their own experiences and imagination and that permitted the identification of shared themes, images, and visions. Second, we sought to examine narrative as a method for placing the social on equal footing with the technological and for achieving harmonization towards shared visions and pathways of the future. We aimed to create scenarios that successfully embedded diverse future energy pathways into social, economic, and political contexts, allowing participants to more readily imagine and tell stories about what it might be like to inhabit those worlds. We wanted energy to be central to the conversation, but neither in isolation nor as a purely technological phenomenon. As we describe in greater detail below, we designed the framing question, "How will Arizonans consume and produce energy in 2050?" to focus thinking on individuals and communities as active agents of change in a place-based environment rather than on abstract energy systems. Finally, we wanted participants to be satisfied that they had participated in a meaningful dialogue about the state's energy future.

The workshop design involved bringing together a small but diverse group of participants with varying knowledge and experience of energy, Arizona's energy history, and the social dynamics of communities in the state. The process was broadly inclusive, enabling individuals with very different levels of knowledge and expertise to contribute to the conversation. Participants represented diverse professional fields and degrees of experience with energy issues. The workshop involved approximately 20 participants with backgrounds from science, engineering, social science, business, policy, and humanities. Participants ranged in experience from senior energy industry executives and high-level policy officials in state government to graduate students with little to no prior experience in the energy sector. The workshop also included a professional facilitator, a graphic recorder, an ethnographer, and a media documentation team. These last three were involved to ensure robust documentation of the workshop process, as an opportunity to learn reflexively about the process of imagining, inventing, and deliberating futures at *Emerge*.

The workshop convened in a small conference room in the ASU Art Museum. After exchanging introductions, opening remarks by the workshop organizers detailed the goals and objectives of the workshop and introduced the focal question. The workshop then followed a relatively traditional scenario planning approach, modified, as we describe in detail below, to promote the centrality of narrative to the group's work. The first portion of the workshop involved brainstorming and deliberation exercises designed to distill the driving forces behind patterns of energy use and energy change in Arizona, especially as those forces expect to play out over the next four decades. Subsequently, the workshop focused on uncertainties associated with these drivers, illuminating especially where participants felt that unknowns would significantly impact future energy system development in the state. Participants brainstormed an extensive array of potential uncertainties then grouped individual uncertainties into larger sets. Table 1 illustrates these groupings of uncertainties. Participants ended the day with preliminary discussions of frameworks for scenario development, ruminating on possibilities overnight.

The second morning, participants reconvened to reflect upon the previous day's exercises and to test possible scenario frameworks. Scenario frameworks were built on pairs of axes, with each axis representing a key uncertainty or group of closely related uncertainties. Variation along each axis represented different possible outcomes for the uncertain variables, with the four corners of the resulting diagram identifying the four scenario spaces (see Fig. 1 for a diagram of this construction). For each pair of axes, small groups brainstormed the four scenario spaces to generate an initial look at what each scenario might look like. All participants then participated in evaluating each set of paired axes and scenarios to see which would generate the strongest set of four scenarios. This testing involved interrogating two primary factors: first, are

Table 1
Illustrative uncertainties in Arizona's energy future.

Social and political will to transform	**Capacity for investing in energy**
•How quickly will Arizonans perceive or experience the risks of climate change?	•Will global, national, and local economies grow or stagnate over the next four decades?
•Will Arizona citizens become more active participants in policy discussions?	•Will energy investors look to Arizona as a place to invest in energy?
•Will Arizona politics accelerate or delay energy system change?	•Will Arizona develop an entrepreneurial energy economy?
Energy freedom – who decides?	**Level of socio-technical innovation**
•Will energy decisions be made centrally or by distributed actors?	•How fast will business models, regulatory structures, or communities change?
•How much information will people have?	•How fast and how far will the relative price of solar energy decline?
•Will Arizona deregulate electricity?	Will radically different technologies of energy production and
•Will Arizona develop a significant energy export sector?	consumption occur, or will energy technologies largely reflect the
•Will new energy development be in large power plants or rooftop installations?	status quo, with incremental advances?

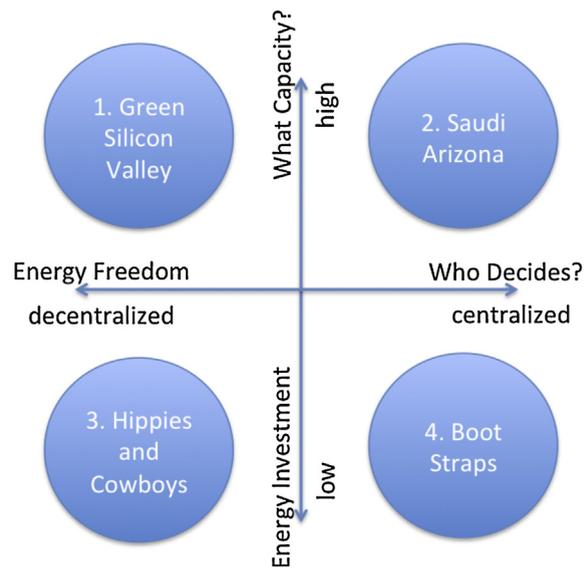| **Change in the external environment** |
|---|
| •How fast will climate change? Will climate shocks occur? |
| • Will water, food, energy, or other resource shortages constrain economic development? |

Fig. 1. Scenarios developed during the workshop.

the uncertainties really strong unknowns, i.e., is there really a question about what will happen? Second, how rich, differentiating, and interesting are the four scenario spaces for challenging people's thinking about the future for both workshop participants and future consumers of the scenarios?

After testing several pairs of uncertainties, the group chose the two axes shown in Fig. 1 and discussed in Section 5 below. Participants then spent the afternoon of the second day exploring the resulting four scenario spaces, using two major methodologies. First, small groups explored what each of these four future worlds would look like: What would characterize these worlds? How would Arizonans consume and generate useful energy forms? Who would be involved in energy development and decisions? What would energy choices in the scenario imply about broader social, political, economic, or environmental dynamics? Second, small groups developed detailed story lines for each scenario using conventional scenario planning techniques, such as writing a series of newspaper headlines/stories that describe what happened between the present and 2050 to result in the world described in the prior exercise. Consistent with news media practices, these headlines/stories were framed in terms of people and institutions as actors, even when they involved new technology developments. Hence, for example, one somewhat tongue-in-cheek headline read, "ASU and University of Arizona researchers build collaborative project on the future of photovoltaic technologies." The four groups then came back together, shared results, provided feedback to one another, and refined the scenarios in preparation for reporting to the *Emerge* plenary the following day. The workshop closed with a discussion of next steps and thoughts about how the results might contribute to subsequent work.

4. Narrative design elements

Throughout the process, the organizers emphasized a narrative approach that encouraged participants to tell stories, both about their own experiences and ideas and about what the future might hold. Here we emphasize four specific design choices that were made to foster narrative engagement and deliberation: (1) the focal question was designed to put people and communities at the forefront of the discussion; (2) workshop participants were selected to ensure that the participants would bring a diverse array of backgrounds, experience, and knowledge with respect to both energy and the social, policy, and community dynamics that surround it; (3) a graphic recorder was retained to create and capture humanist imagery in the workshop deliberation; and (4) elements in the process were designed to encourage factual and values-based contributions in forms that supported storytelling and narrative articulation, such as imagining news media headlines occurring in the future that reflected key events that led to each future scenario. Altogether, through these explicit design choices, as well as rules of civil engagement, the workshop sought to ensure that all participants felt part of the workshop deliberations, free to bring their own insights and perspectives, whatever their background, and able to create collective stories about the future that would help participants and others in planning for the state's future. In this fashion, the aim was not to have fanciful imaginations of dystopian or utopian futures, but rather to ground discussions in realistic, plausible futures (Barry, Ellis, & Robinson, 2008). The ultimate result engaged participants in a collaborative experience, to our knowledge not previously undertaken, with regard to deliberating over a state or region's energy future.

The first design choice entailed the selection of the focal question for the workshop: "How will Arizonans consume and produce energy in 2050?" Alongside the title of the workshop, which had been chosen to emphasize the bringing of the

human back into the deliberation of energy futures, this question put the people of Arizona squarely in the focus of discussions. This framing departs from traditional energy policy approaches that focus on the production, distribution, and adoption of energy-related technologies. By emphasizing the people of the state, the energy sector was situated in its larger social and political contexts, enriching deliberations of the implications of energy systems for the fabric of society. This also helped to bound discussions to a specific place and community: the state of Arizona, the people within, and their actions and interactions in the realm of energy. Since the participants were all from or in some way connected to Arizona, this choice encouraged participants to tell their own stories about energy, to imagine themselves and their communities as integral to the scenarios developed, and, generally, to displace the conversation away from a narrow focus on energy technologies and prices. With some reiteration over the course of the two days (the focus of energy debates on technology and price can be hard to dislodge), the workshop succeeded in its objective of broadening discussions.

The second design choice was to involve participants from a range of disciplines and backgrounds and different levels and kinds of knowledge of and experience with energy. For example, participants included several graduate students in the humanities and social sciences whose research focuses on energy ethics, energy justice, and the politics of energy development; leading ASU researchers in the fields of ecosystem services and social and institutional dynamics in communities; and state and federal officials engaged in energy policy but not, by training, energy specialists. The diverse mix had a very important effect in widening the topics that received substantive focus during the workshop, ensuring that issues of concern to many groups entered into the workshop's deliberations, including energy consumers and workers, communities that inhabit lands near energy production facilities, technology developers, and other people with significant stakes in energy development. It also had the effect of demonstrating that, when properly framed, energy futures can be engaged meaningfully even by people with little or no technical expertise in the field.

Third, the workshop employed a graphic recorder who introduced an artistic element to help remind people of their own thoughts and visions and to return them to the issues of meaning, significance, and values throughout the conversation. Complementing the workshop facilitator, who led the process, the graphic recorder combined the roles of artist and interpreter in observing participants, listening to their stories, recording their journey, and helping them visualize and organize key concepts in real time. These images were drawn on large butcher-block paper sheets along two of the walls, providing live representations and interpretations of key ideas, concepts, and imageries under discussion, while also helping tie the individual workshop into the larger art-science engagement of the *Emerge* conference as a whole.

The final design element was to emphasize the sharing of stories and narratives in the conversation. Workshop organizers highlighted to participants from the outset that the process was one of collaborative engagement with and especially ownership of stories. This meant deemphasizing, at least for the purposes of this workshop, data, statistics, and models. It also meant explicitly welcoming storytelling about participants' past experiences and about how the state's residents may live, work, and play in the future. By fostering an environment where participants felt free to share stories, imaginings, and feelings, the workshop was enlivened as a space for thinking about not just energy futures but also community futures. This emphasis was further strengthened by procedural choices that highlighted narrative and storytelling elements. Instead of explicit scientific data or models of future patterns, the participants used personalized stories as the building blocks for their scenarios. These elements helped create a narrative timeline of plausible and logical developments that led up to the final scenarios.

5. Deliberating scenarios

To design their scenarios, shown in Fig. 1, participants in the workshop selected two axes of uncertainty: (1) "Energy Freedom: Who Decides?" or the degree of centralization or decentralization in energy decision making; and (2) "Energy Investment: What Capacity?" or the level of investment in state energy development. Building on these axes, participants then imagined and developed scenarios for each quadrant through two collective storytelling exercises. The first involved telling a story for each scenario about what the future looked like to its inhabitants. The second involved telling a story about how that future had evolved from the present. Small groups worked in parallel for each scenario, and in both exercises, deliberation was extremely robust in all four groups. Throughout the process, individuals narrated their own experiences and expectations as inputs for developing future stories.

Stories about the "Energy Freedom" axis ranged, at the extremes, from highly decentralized to highly centralized energy futures. In developing scenarios about decentralized decision making, participants deliberated the deregulation of energy markets, which is actively under discussion in Arizona energy politics, as well as the development of distributed energy resources, in which individual businesses or households would invest in small-scale wind, solar, or other sources of energy generation and storage, which is also actively taking place locally. They also discussed the possibility that Arizona might evolve towards becoming an energy innovation hub, with many companies setting up shop in the state as part of a novel innovation ecosystem, which is a goal of many of the state's economic development agencies. Centralized decision making, on the other hand, was envisioned by the participants as retaining the influence of large utilities and corporations, as well as centralized government regulatory agencies, such as the Arizona Corporation Commission (ACC), as the primary determinants of energy policy. While many of the discussions of centralized decision-making focused on existing Arizona energy institutions (the utilities and ACC), other participants offered stories involving new large-scale energy investors entering the Arizona market, so long as the latter option occurred in a highly centralized way with a small number of players and stemming from existing big businesses. One story of centralized decision-making discussed the possibility of

multinational oil corporations forming a centralized, large-scale solar-to-fuel industry in the state. Another story focused on the growth of large companies leasing rooftop systems to millions of state homeowners.

Stories focused on the "Energy Investment" axis focused on the two extremes of high investment and low investment. For the most part, deliberations focused on financial capital investment, but also explicitly included the capacity for human capital, public attention, and political will. In a future energy landscape with a low capacity for investment, participants suggested there would be few resources and little will to make dramatic changes or investments in energy systems as a whole. Stories examined the possibility of incremental changes that maintained the status quo, but also included the possibility of an erosion of status quo systems in favour of alternative energy sources, but on very small scales with limited resources. Participants observed that these stories were consistent with the current financially strapped positions of many of the state's utilities, the relatively low willingness of the state to raise taxes for infrastructure investment, and the ongoing impacts of the economic recession, which were still a key element in US public deliberations in 2012.

By contrast, stories told about future energy landscape with a high capacity for investment started with an assumption of not only greater financial capital available for energy-related projects but also a significant supply of talented people, public will, and policy makers focused on allocating new resources and making commitments to new energy facilities on a large scale. These stories portrayed the will for change as setting the stage for disruptive innovation and acceptance of changes on a larger and potentially massive scale. Importantly, this investment could occur in a wide variety of ways, focusing on different kinds of investments, depending on how participants made sense of their particular scenarios. In narrating energy abundance, participants told a variety of stories about current trends that could grow, including outside investors looking to the state as a place to develop renewable energy, innovative communities in the state that were already encouraging energy development projects, and the acceleration of rooftop solar investments being made by individual homeowners.

Based on these deliberations, workshop participants developed four scenarios. Following is a brief summary of each scenario.

Scenario 1: "Green Silicon Valley" (decentralized decision making; high investments)

Arizona leads a distributed solar economy and becomes the global centre of solar innovation with abundant sun, top-flight universities, pioneering solar entrepreneurs, and willing investors. Innovative technologies provide for inexpensive solar power integrated into everything. Your house, your car, your phone—each captures and stores the sun's energy. Solar projects proliferate in neighbourhoods and communities and great strides in conservation are made. Not just better solar panels but also integrated solar technologies appear, taking up nearly every square inch of manufactured structures that might capture the sun. Utilities disappear as a robust market emerges in which most families produce as well as consume energy and anyone can buy and sell energy to anyone else. Entrepreneurs and venture capitalists flock to the state for economic and social opportunities. If you are not operating in the Arizona energy market, you are a second-tier company. Consistently the first to bring winning technologies to market, Arizona becomes a solar-powered haven in the desert. Group discussion noted both similarities and differences between this world and the culture of information technology start-ups, as they exist today.

Scenario 2: "Saudi Arizona" (centralized decision making; high investments)

Arizona's vast deserts with excellent solar resources power the world. Driven by intensifying concerns about climate change, massive new investments in commercial energy facilities soak up Arizona's abundant sunshine and land and turn the state into a desert power. Bigger even than the oil fields of the Middle East, massive new industrial facilities turn sunlight into both electricity and fuel, and new nuclear plants are built. Pipelines and transmission lines crisscross the state. An oligarchy of "energy barons" presides over the state's politics and the boom-and-bust of the new energy economy. Native American tribes leverage their land rights with high value long-term leases to international energy investment groups. Exports to the lucrative energy markets of California, the world's ninth largest economy, and other states, enable Arizona to emerge as a world leader in low-carbon energy and drive continued economic and population growth in the state. Despite lacking any significant role in energy decision-making, residents of the state stand to benefit as the largesse of such investment is distributed to improve quality of life for Arizonans, even as the state's politics evolves to become like that of other petro-states.

Scenario 3: "Hippies and Cowboys" (decentralized decision making; low investments)

Resilient Arizonans confront energy and economic decline. Brownouts and blackouts grow as technology failures accumulate. Citizens foster strong community ties to contend with water and resource shortages and continued economic malaise. Low levels of government action, reinforced by low tax policies, undercut public and commercial investment in infrastructure. Transportation over long distances becomes difficult. Dust accumulates and growth stagnates in Arizona. The mobile workforce leaves, creating a vicious downward circle for population and human capital. Cities fragment, inducing both urban and rural communities to become more insular and self-reliant, or else decline. Successful communities become stronger, more diverse, smaller, and tightly knit, rebuilding the social ties into the primary resources for innovation,

replacing financial and technological resources. Gas prices continue to rise. Low-input user innovation becomes common. Solar panels spring up on every rooftop, electric vehicles proliferate, and communities secure their own energy futures through do-it-yourself technology development.

Scenario 4: "Boot Straps" (centralized decision making; low investments)

Arizonians make do with less. Arizona confronts a lengthy period of economic weakness, low investment, and declining infrastructure reliability. Governmental leadership without resources leads to ineffectiveness. Electricity and fuel shortages lead to high prices and reduced energy security, disproportionally affecting the state's poor. Political tensions run high. The state's centralized utilities face severe limitations on generating new supplies and increasingly push energy efficiency and conservation to squeeze the most value out of the existing energy infrastructure. Centralized management of consumer energy use (using smart grid technologies, where available, or brownouts, where not) grows, in an effort to ensure that reliable energy is available for industrial needs. Those who can leave the state do, but those who stay pull themselves up by their bootstraps and adjust to the new normal. Similar to the previous scenario, a rise in social innovation differentiates successful communities from those that flounder and may not survive.

6. Discussion and conclusions

Overall, the workshop provided an important learning experience in narrative-based approaches to envisioning and deliberating energy futures. Here we discuss two key questions. First, in what ways did the narrative approach used to encourage an emphasis on deliberation and storytelling about energy futures succeed at achieving our three objectives: drawing out the social as well as technological dimensions of energy transitions; elucidating multiple narratives from diverse participants and helping participants move beyond their own narratives to recognize how various narratives might harmonize into larger shared narratives and enable pathways to energy system transformation; and engaging participants in a robust discussion of Arizona energy futures? Second, more broadly, what did we learn about energy futures from the workshop's narrative-based explorations?

Did our narrative approach work? Were we able to facilitate the new kind of dialogue about energy that we had intended? For the most part, the answer is yes. Most importantly, from the perspective of the organizers, the workshop succeeded in eliciting rich, thoughtful conversations among participants from highly varied disciplinary backgrounds and with very different levels of experience with and varieties of knowledge about energy. These deliberations thoroughly humanized energy policy, putting energy into productive conversation with diverse facets of human experience, social identity, and public meaning. Qualitatively, there was a good balance of participation, healthy respect for alternative positions, and a feeling of inclusion among participants from very different backgrounds and experiences with energy. In conversations, we observed participants draw on the telling of stories to help motivate a contribution to the topic under discussion, to give meaning or weight to a proposition, or simply to offer up an experience that brought a new perspective to the challenge of envisioning energy futures. The resulting deep and broad conversation surfaced an extraordinarily rich set of ideas about energy in Arizona in the present and future. Based on these observations, and especially on the observed ability of participants with little knowledge or experience of energy issues to participate fully, we believe our experience warrants the conclusion that narrative approaches could be used as the basis for deliberations of energy futures among other groups and communities with comparable disparities in levels of energy expertise and diverse knowledge of and positions in energy systems. Narrative storytelling and deliberation may thus assist in both the "publicizing" and "socializing" of energy policy ([Miller, Richter, & O'Leary, 2015](#)). In our experience with *Emerge*, narrative approaches helped facilitate the imagination and discussion of human-centric energy futures. Again, this sits in contrast to the current focus on techno-economic based futures formation that currently dominates the energy sphere.

Consider, for example, the scenarios themselves. While each addresses the energy future of the state, the four were, together, quite different from what one might expect in a conventional energy policy analysis. The scenarios focused only at the margins on the mix of energy fuels and did not delve significantly into the technical details of energy technologies likely to be experienced in the future. Likewise, they generally avoided efforts to project energy demand and price curves out into the foreseeable future. Instead, participants focused their storytelling in the scenarios on the links between the different kinds of energy system that might exist and the character of the community in which it might be embedded. It was this community-based focus that was particularly transformative and allowed the participants to envision futures that were not only qualitatively different from the status quo of other futures-based scenario generation processes but also in their implementation and effect on the participants, as noted above.

The futures presented in this workshop highlight multiple narratives that emerged in the workshop's deliberations about both energy and Arizona: about entrepreneurship and innovation in the state; about the state's diverse deserts and environments; about industrial infrastructure and political transformation; about economic decline and prosperity; about urban political and economic centres and rural communities. The resulting scenarios reflect processes of deliberation and harmonization that brought elements of these diverse narratives together to create meaningful stories of plausible futures. They highlight the deep relevance of energy choices to the state, going far beyond numbers to capture the notion that our societies are fundamentally organized around core energy systems and their governance regimes, which enable societies to thrive in various forms. Put another way, the assumption that energy system change is determined by technological

innovation was shown to be quite erroneous in every scenario considered. To a large degree, energy innovation reflects social, political, and economic structures that induce it to emerge in many various forms, each of which ripples in turn through society, markets, and politics. Back to the premise of this paper, energy trajectories are, indeed, a matter of societal choice even if not necessarily directly and linearly.

It is particularly apt to observe, in this regard, that when asked to present their scenarios in depth, each small group adopted a storytelling approach, narrating the history of their alternative future as though walking their colleagues through the storyboard of a proposed film. Further follow-up with the scenarios developed will be required to determine whether this kind of narrative-based conversation might evolve into more actionable and substantive contributions to formal policy dialogues about energy. Minimally, however, it showed substantial promise for elevating participants' awareness of energy change as a social problem with legitimate roles for broader public engagement. If this approach were adopted in communities, it is plausible to suppose that it could lead to robust and sustained involvement by a wider range of publics in the framing and agenda-setting stages of policy development, which can certainly influence the trajectory of policy options considered as viable by decision-makers (Graffy, 2008). Testing this hypothesis in a community group and with more time and a more rigorous analysis is an important next step in our efforts.

Participants also left the workshop intending to continue to engage in deliberations around Arizona energy policy and, generally, with considerable enthusiasm for narrative approaches. One participant who was initially unfamiliar with and quite skeptical of the use of scenario methods and, in particular, in the use of narratives, came away conjecturing that the approach could offer a valuable tool for politically divided policymakers trying to deepen conversations about Arizona energy policy options. This participant found that the opportunity to tell stories grounded in her own experience helped her to draw together multiple threads from many people's contributions to the conversation. Another participant found her initial, partially formed convictions confirmed that energy policy is first and foremost not a technical problem but a social problem, and that humanistic and narrative approaches are critical elements of an overall strategy for envisioning and accomplishing a sustainable energy transition. A third participant, who participates actively in science policy, observed afterward that the conversations had been highly valuable and that he intended to develop and implement similar strategies in the future in other domains. Results of the workshop were subsequently utilized in classes and other forums at ASU to explore the potential for additional deliberation. *Emerge* also developed and presented materials from our workshop for an exhibit at the ASU Art Museum, in which visitors were asked to reflect on the four scenarios and select a preferred outcome.

The workshop also contributed to the development of valuable insights, helped to capture and fire people's creativity about energy futures, and enabled people to experience energy alternatives via their imagination. Participants' experiences during the workshop were generally enthusiastic and highly engaged, especially as the workshop progressed. They held passionate and robust deliberations about the nature of the driving forces for energy in Arizona, about interpretations of the spectrums of key uncertainties, and about the implications for each scenario and the story it told.

Just as importantly, from our perspective, the workshop resulted in a number of important new insights into not only the specifics of energy futures in Arizona but also the more general question of energy's social dynamics and relations. Solar energy played a prominent role in all four scenarios developed, for example, a reflection of general agreement among participants that solar will grow dramatically in significance over the next three decades in Arizona, no matter what else happens. However, the role, configuration, and timing of solar energy development differed markedly across scenarios. In two, solar took the form primarily of large-scale, utility-owned facilities, in one case to meet Arizona's energy demand and in the other for energy exports. In the other two scenarios, distributed solar energy dominated, again, in one case to meet local community energy needs while, in the other, the heart of a new and vibrant innovation economy.

The key question, going forward, is how to develop and adapt the ideas explored in this workshop to strengthen the capacity of communities to imagine and constructively deliberate sustainable energy futures. Even with robust processes, citizens may not actively participate in energy choices, leaving in place the historical technocratic, centralized customs of energy decision-making. Public alienation is an established concern in administrative governance in general, not just with regard to energy (Durant & Ali, 2013; Wynne, 2001). However, it can be especially problematic in the context of large-scale energy transitions, as wholesale reconfigurations of social and technological systems elevate and mobilize public concerns about risks, threats, and opportunities. However, there is as much reason to assume that public awareness and interest in energy engagement will grow rather than decline. In the United States, public mobilization has occurred around myriad energy decisions: coal plants in the Midwest, solar thermal power plants in the Southwest, wind farms in California, the Midwest, and along the East Coast, fracking in Pennsylvania and New York, oil pipelines in Nebraska and Texas, oil drilling moratoria along the Gulf Coast, and an absence of progress on climate policy in Washington, DC (Kinchy & Perry, 2012; Negro, 2012). In the aftermath of the Fukushima Daiichi nuclear disaster, widespread social protests around nuclear power arose in Japan, India, and throughout Europe (Abramsky, 2010; Bhadra, 2012, 2013).

The transitions confronting us are not just whether and where we build new power plants but rather what kind of a world we inhabit, what kind of climate we enjoy, and who prospers and who thrives. These are constitutional questions that, as the scenario workshop clearly suggested, ultimately define characteristics of societies: what they can and will become. Publics may continue to sleepwalk through large-scale changes in the technological constitution of society, as Langdon Winner has observed (Winner, 1986). Alternatively, they may look for new ways to open up conversations to broader participation and thus to enable more civil deliberation about our collective societal and energy futures.

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