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Smart Grid Coverage in U.S. Newspapers: Characterizing Public Conversations

An analysis of The Wall Street Journal, USA Today *and* The New York Times *from 1998 to 2013 suggests that media coverage of smart grid issues focuses more on benefits than risks. Coverage peaked in 2009 with substantial federal-level investment in the American Recovery and Reinvestment Act.*

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I. Introduction

Electricity fulfills an ever-increasing role of critical societal functions, and calls to modernize the U.S. electric power system are growing stronger (SmartGrid, 2013; Beyea, 2010). Among national leaders, including both President Bush and President Obama, the creation of a ''smarter'' grid has been repeatedly framed as a critical policy priority. While building a smart grid (SG) is a costly political and financial commitment—infrastructure investments on the order $300–500 billion over the next 20 years have been estimated for U.S. grid modernization (EPRI, 2011), the costs of not investing in this critical infrastructure are also high. But building a smarter grid is not simple, and it requires the alignment of national, regional, state, and local priorities spanning multiple jurisdictions. SG development and policy creation is challenged by many

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public and private actors with different priorities and conflicting agendas (Wald, 2013; Stephens et al., 2013).

Understanding how public conversations about SG are evolving over time helps to engage diverse stakeholders in the design and implementation of future electricity systems. This research seeks to inform SG development by analyzing the complex and evolving public conversations about SG through media analysis. The media play a dual role in public engagement of policy issues: the way the news media cover an issue can contribute to shaping public opinion and the extent and type of news coverage can reflect and communicate public priorities within the policy process (Graber, 1997; Hansen, 1991; McCombs, 2002; Gamson and Modigliani, 1989). National-level newspapers influence, inform and shape public discourse on energy, technology, climate change, and environmental issues, and the extent and level of coverage on these issues also influences public perception. Newspapers report on ongoing technological and social developments, policy issues, and energy-relevant financial ventures, as well as provide opinion pieces. Analysis of SG media coverage provides an opportunity to assess the public discourse surrounding SG development.

The term *smart grid* has come to represent a complex set of technological as well as social changes with potential to upgrade, improve, and transform the management and development of electricity systems (Stephens et al., 2013). The notion of SG resonates with many because of its multi-faceted potential to contribute to multiple energy policy objectives. By integrating changes throughout the electricity system including generation, transmission, distribution, and consumption,

Analysis of SG media coverage provides an opportunity to assess the public discourse surrounding SG development.

SG promises a wealth of benefits. From enhanced reliability, increased resilience, stronger energy independence, improved efficiency, reduced costs, increased economic competitiveness, improved environmental quality, to enhanced citizen and consumer engagement, SG is often presented as a technological panacea for the electric system. Broad SG appeal is evident, yet SG also presents unique policy challenges for managing privacy, cybersecurity, interoperability, and for some, uncertain health risks. Additionally, determining how (and by whom) SG investments should be financed remains an ongoing challenge. Additional benefits often included in SG discussions are increased renewable power, lower greenhouse gas emissions, electric vehicles, and the creation of microgrids, a term which commonly refers to locally networked distributed generation with potential for islanding.

This article analyzes SG discourse in the three largest-circulating U.S. newspapers, *The Wall Street Journal*, *USA Today*, and *The New York Times*. In each article we assess the technological components mentioned, the framing of SG risks and benefits (Stephens et al., 2008), and the actors presented as influencing and being influenced by the development of SG. We present background on our approach, results and then concluding discussion.

II. Approach Justification

Media analysis provides a useful approach to analyze public discourse because the news media represent and reflect public conversations and public policies (Graber, 1997; Hansen, 1991; Gamson and Modigliani, 1989; Feldpausch-Parker et al., 2013). The media also have potential to influence public perception and reinforce – or potentially change – the direction and scope of public discourse on a particular issue

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(McCombs, 2004). Salience of reporting across newspapers demonstrates the relevance and ''newsworthiness'' of a topic for specific audiences and timeframes. Analysis of newspaper coverage also allows for a characterization of the types of challenges and opportunities mentioned in public conversations. With respect to technical issues including energy policy and energy technologies, the news media also play a critical role linking technical assessments of experts to the more socially recognizable assessments of laypersons (Dunwoody and Neuwirth, 1991; Gregory, 1989; Murray et al., 2001; Singer and Endreny, 1987).

To characterize the different ways that energy technologies are communicated in the media we use the SPEED (Socio-Political Evaluation of Energy Deployment) framework that identifies six distinct frames including: Technical, Economic, Political, Health & Safety, Environmental, and Cultural (Feldpausch-Parker et al., 2013; Boyd et al., 2013; Chaudhry et al., 2013). This framework provides structure to analyze and explore interactions among multiple socio-political factors (beyond technical feasibility), which influence energy technology deployment. This includes regulatory, legal, political, economic, and cultural factors using multiple approaches including policy review (Wilson and Stephens, 2009), media analysis (Feldpausch-Parker et al., 2013; Stephens et al., 2009), and stakeholder interviews (Fischlein et al., 2010, in press). The SPEED framework adapts and operationalizes Luhmann's (1989) theory of society as a system made up of self-organizing subsystems that function interactively (Luhmann, 1989, 1995).

New demands on electricity systems to provide reliable and low-cost power are now coupled with demands for increased efficiency, enhanced security, and a reduction in environmental and climate impacts. Meeting these additional demands requires new sensors and information and communication technologies (ICT) to manage an increasingly complex electricity system; SG has become the catch-all phrase which represents these changes. Many discussions of SG highlight its ability to improve system efficiency by reducing the costs to generate, deliver, and consume electricity. SG also is associated with potential to enhance system reliability and resilience by optimizing grid performance, ensuring power quality, and enabling quicker restoration of power after outages. SG is crucial for the integration of variable renewable resources like wind and solar power, and SG is also linked to enabling more distributed power generation. Integrating plug-in electric vehicles, and creating local microgrids are also promises of SG. Adoption of dynamic pricing and smart meters could allow consumers to monitor and manage energy in a more responsive way.

Despite its potential benefits, diffusion of SG technologies in the U.S. has been patchy.

Despite its potential benefits, diffusion of SG technologies in the U.S. has been patchy, the level of investment remains daunting, and the path forward for SG remains uncertain and often contested (Amin and Gellings, 2006; Levinson, 2010). Societal recognition of the importance of SG in the U.S. is evident in the inclusion of $4.5 billion in SG government support in The American Recovery and Reinvestment Act (ARRA) of 2009 (DoE, 2010), and in local, state, and regional policies, projects, and initiatives promoting the development of SG systems throughout the U.S. (Minnesota Dept, 2010; PR News Wire, 2010).

Public opposition to SG has also emerged, with consumer concerns over cost, privacy, cybersecurity, and health becoming increasingly prevalent (Levinson, 2010; Investors Business Daily, 2010; Hess, 2013). Health concerns are primarily

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associated with risks of exposure to radio waves emitted from wireless smart meters installed in homes, though this remains similar to emissions from cell phones or wireless Internet routers (Hess, 2013). Complex jurisdictional issues coupled with institutional and economic challenges of SG deployment are apparent, yet social science analysis of non-technical sociopolitical factors influencing SG development remains limited. This article attempts to bridge this gap.

III. Methods

To characterize public discourse on SG in the U.S., we analyzed the content and framing in SG-related articles from 1998 to 2013 in *The Wall Street Journal (WSJ)*, *USA Today*, and *The New York Times (NYT)*. *The WSJ*, the largest circulating newspaper in the U.S., focuses on business and financial news with a total digital and hard copy circulation of 2.29 million copies. *USA Today* is a more general newspaper distributed in all 50 states with a circulation of 1.7 million digital and hard copy editions. *The NYT* has a circulation of roughly 1.6 million digital and hard copies (Alliance for Audited Media, 2013). We selected these three newspapers because they represent national-level discourse across the country and reach a wide range of different audiences. While *USA Today* is truly national in that it does not have a specific geographical focus, *The WSJ* and *the NYT* are distributed nationally but are both based in New York City, resulting in an East Coast orientation and higher readership in the New York region.

A. Searching for SG articles

To find articles on SG we used the Factiva database (which provided access to all three newspapers) and searched all article types (news, business, editorials, etc.) published between 1998 (the year in which the first article mentioning SG was published) and Dec. 31, 2013, that included the following phrases: *smart grid*, *smart meters*, *smart metering*, *smart electric grid*, and *smart electricity grid*. We reviewed the retrieved articles for relevance to electricity systems and extent of focus on SG. Articles that were not related to electricity systems (e.g., articles that discussed smart parking meters) and articles that only mentioned the search terms without further relevance or context (e.g., John Mayer who is the CEO of the SG Company X joined the meeting) were removed from the sample. We classified the remaining articles into two categories (SG-focused and SG-subsection) based on the extent of SG discussion; SG-focused articles were those where the entire focus of the article was SG or a specific SG technology, while SG-subsection articles included articles where the main focus of the article was not exclusively SG, but SG or a SG technology was discussed within a subsection.

B. Analysis of articles

We used the text analysis software NVIVO 10.0™ to analyze (1) salience in terms of placement (i.e., whether published in business, op-ed, energy section, etc.), (2) the diversity of technological components mentioned (**Table 1** describes technology categories used), (3) the frequency and type of SPEED frames used to describe

Table 1: Categorization of Different Technological Components Associated with SG.

Technologies	Examples
Transmission and distribution	Power lines, transformers, voltage, AC, DC, relays, capacitors
Smart meters	Smart meter, advanced meter
Energy storage	Batteries, fly wheels
Sensors, information, and communication technologies	Sensors, software, hardware, SCADA
Renewable generation	Wind, solar, photovoltaic, geothermal, wave, tidal
Electric vehicles	Volt, Plug-In Prius, Tesla
Consumer load appliances	Programmable dishwashers, air-conditioning
Consumer interface tools	Websites, apps, cellphone

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risks and benefits, and (4) the diversity of actors mentioned.[1]

Two researchers independently coded each article, and they reached an intercoder-reliability of 90 percent and a Kappa value of 0.8, indicating a high level of consistency. We analyzed *which technologies* the articles discussed by calculating the frequency of mentions of different technologies for all articles. Among the SG-focused articles, the co-occurrence of different technological categories was assessed using the Pearson's correlation test, a statistical correlation method that can be used to analyze the degree of association between two dichotomous variables (Hair, 2006). The resulting phi-coefficients determine the strength of the association in mentioning the presence or absence of different technology components in the articles.

Table 2: Categories of Different Actors Associated with SG.

Actors and Institutions	Examples
Electric Consumers	Home owners, businesses
Electric Utility and Power Companies	California Edison, PG&E, N-Star
Private Sector	Siemens, General Electric, Cisco
Federal Government	Obama, White House, DOE, EPA
State Government	State public utility regulator, state legislator
Independent System Operator or Regional Transmission Organization	ERCOT, RTO, NE-ISO
Academia	Universities and academic researchers
Non-profit sector	Sierra Club, Conservation Law Foundation

Statistically significant ($p \leq 0.05$) correlation coefficients of |0.4| are generally considered to show a moderate degree of association between two variables and correlation coefficients of |0.7| and higher have a strong degree of association (Cohen, 1988).

We also analyzed *who* was presented as the influential or knowledgeable actors in these articles (**Table 2**). We analyzed the framing of SG risks and benefits in all SG-focused articles characterizing the frequency of technical, economic, political, health and safety, environmental, and cultural frames (**Table 3**).

IV. Results and Discussion

A total of 231 articles were retrieved from the search including 87 SG-focused articles and 144 SG-subsection articles (**Table 4**).

Table 3: Descriptions of SPEED Risk and Benefit Frames.

SPEED Frame	Benefit	Risk
Technical	Improve electric infrastructure, allow creation of a more reliable grid, better integration of renewable resources	Increased grid vulnerability, cyber-attacks, reliability concerns of smart meters
Economic	More efficient use of the electric grid, strengthen economy (jobs, manufacturing), save money because there is less need to build new facilities	Increased cost of electricity, cost of SG outweighs benefits
Political	Positive political ramifications, i.e., energy independence, enhanced national security, energy security	Negative political ramifications, i.e., public frustrations, difficult legal and regulatory process
Health & Safety	Reduced respiratory problems from improved air quality	Health and safety concerns associated with power lines, smart meters (i.e., wireless radiation, headaches)
Environmental	Reduce GHGs or carbon emission, mitigate climate change, energy conservation, less air and water pollution	Potential threat to ecological health, i.e., bird kills, protected species, habitat destruction or disruption
Cultural	Increased individual awareness of electricity consumption behavior and electricity costs, behavioral change	Privacy concerns, fear of loss of control over appliances or data, inequality concerns (e.g. elderly, low income)

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Table 4: Number of SG Articles in Three National-level Newspapers 1998–2013.

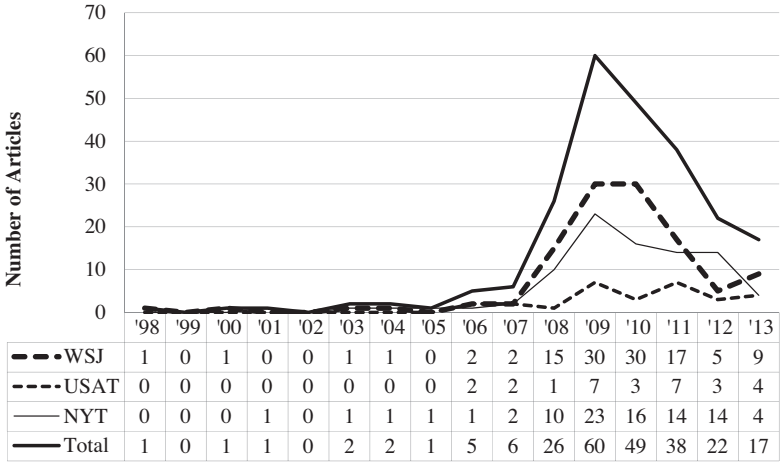
	Wall Street Journal	USA Today	New York Times	Total
SG-focused	40	13	34	87
SG-subsection	74	16	54	144
Total	114	29	88	231

A. Salience of smart grid in the media

The frequency of articles mentioning SG was low until 2007, which was the year of the Energy Security and Independence Act (Figure 1), when public discourse on energy issues increased. In 2008 and 2009 the total number of SG articles increased significantly and decreased again after 2009. The increased attention to SG in 2009 is likely related to an important policy driver, the enactment of the American Recovery and Reinvestment Act (ARRA or ''Stimulus Bill'') in Feb. 2009, which included $4.5 billion in federal funding designated for SG (Aldy, 2011). This stimulus funding resulted in rapid deployment of smart meters in communities throughout the country which led to increased media coverage of SG and some opposition and controversy. President Obama's related speeches explaining the energy-related investments within the stimulus bill stressed the importance of an intelligent electric infrastructure in the U.S., explicitly mentioning SG. This ''stimulus bill'' is discussed in 57 percent of all articles published in 2009, in 16 percent in 2010, 13 percent in 2011, 9 percent in 2012, and 12 percent of the articles published in 2013.

The *WSJ* has the greatest SG coverage from 2006 to 2011 with a total of 96 articles during that period. In 2012 the *NYT* devoted more articles to SG than the *WSJ* and *USA Today* combined with coverage increasingly focused on big storms connecting the vulnerability of the electric grid to potential benefits of SG.

More SG articles were found in the ''Business and Finance'' sections than in other sections (Figure 2), highlighting the investment opportunities in building SG infrastructure. Variation in section distribution among the different newspapers is apparent. The *WSJ* had the highest percentage of SG articles in the special ''Energy'' section, while over 70 percent of all the *USA Today* articles were found in the ''Business and Finance'' sections. The *NYT* published the most editorial/opinion pieces focusing on different government investment, power outages, deregulation, and sustainability.



	'98	'99	'00	'01	'02	'03	'04	'05	'06	'07	'08	'09	'10	'11	'12	'13
WSJ	1	0	1	0	0	1	1	0	2	2	15	30	30	17	5	9
USAT	0	0	0	0	0	0	0	0	2	2	1	7	3	7	3	4
NYT	0	0	0	1	0	1	1	1	1	2	10	23	16	14	14	4
Total	1	0	1	1	0	2	2	1	5	6	26	60	49	38	22	17

Figure 1: SG Coverage in the Wall Street Journal, USA Today and New York Times Newspapers from 1998 to 2013

B. Smart grid technologies

A broad representation of different technologies associated with SG is mentioned in these articles (Figure 3), and most articles mention multiple different SG technologies (Figure 4). More than half of all articles mention smart meters as the ''key component'' of the bidirectional utility-consumer relationship in the SG network, about 40 percent mention information and communication technologies, and renewable energy is mentioned in almost 30 percent of articles.

Analysis of co-occurrence of different technologies using

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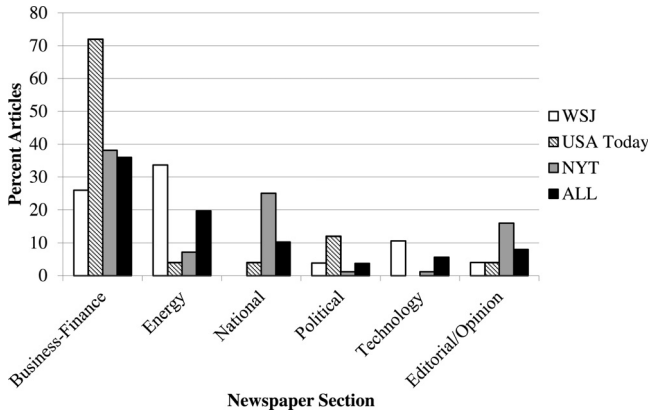

Figure 2: Placement of SG Articles from 1998 to 2012 within Each Newspaper, Demonstrating the Broad Salience of SG

Pearson's test correlation coefficients demonstrates two distinct technology-association pairs in the data. Consumer interface technologies and consumer load appliances tend to be mentioned together (positive degree of association ($r = 0.41$)) and energy storage and electric vehicles (EVs) are discussed together ($r = 0.49$). This quote from the *WSJ* demonstrates how storage and EVs are connected:

> Mayor Wynn envisions the parked electric cars plugging into a network operated by the city's utility, which would then use the powerful car batteries as a big storage system from which to draw power during peak demand (Fialka, 2007, p. A1)

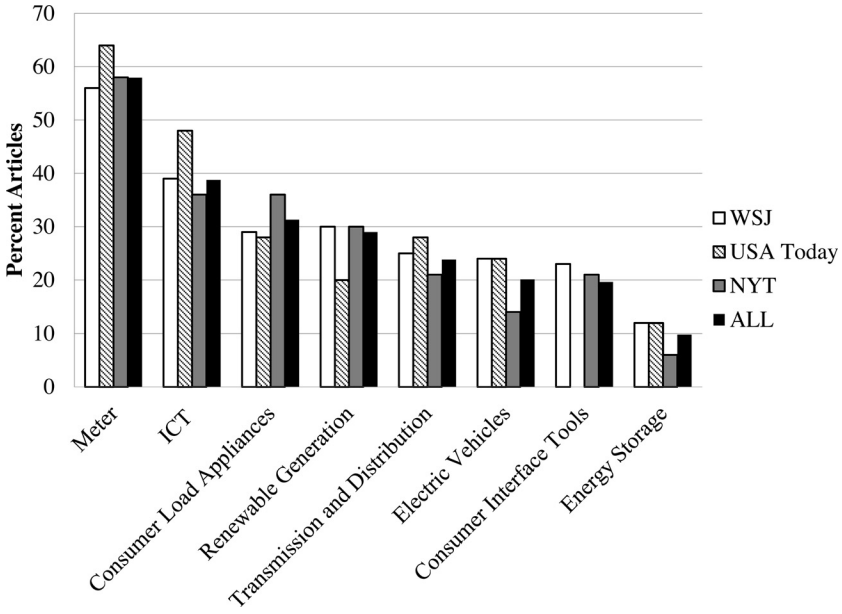

Figure 3: Percent of Articles from 1998 to 2012 that Mention Each Category of Technology
Energy storage is featured the least while electric cars receive considerable attention (mentioned in 21 percent of articles). ICT software forms an integral part in the technology mix of SG (mentioned in 38 percent of articles). Renewable energy generation is mentioned in almost 30 percent of all articles.

Although these technologies are mentioned together in these articles, these linkages remain in early stages of deployment. The potential of these technology pairings seems to provide intrigue for SG coverage, while other possible technology linkages (such as the potential link between renewable generation and electric vehicles) are less prominent.

Smart meters are the technology mentioned the most, with roughly a third of all SG-focused articles triggered by smart meter installation. The *NYT* had the most, with 44 percent of articles focused on smart meter installations. The *WSJ* and *USA Today* focused on smart meter installations in only about 25 percent of the articles.

C. SPEED framing of smart grid risks and benefits

In all newspapers benefits (positive SPEED framing) were mentioned more often than risks (negative SPEED framing) when discussing SG (**Figure 5**). Benefits were mentioned more than risks for the technological, economic, cultural, and environmental SPEED frames, while risks are mentioned more often only in the health & safety and political SPEED frames.

Technological and economic frames dominate the SG discourse while the political frame was largely absent. The minimal political framing is different from media analysis of

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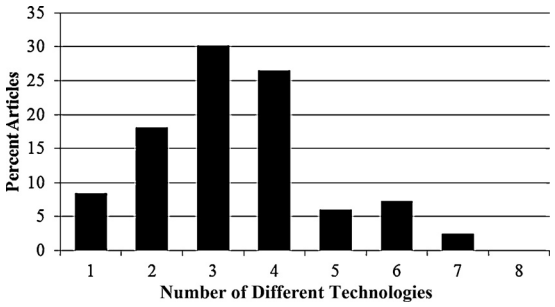

Figure 4: Number of Technologies Mentioned within Individual Articles from 1998 to 2012
Most articles mention multiple different technologies; only 8 percent of articles mention only one technology. No article mentioned all eight of the different technology categories.

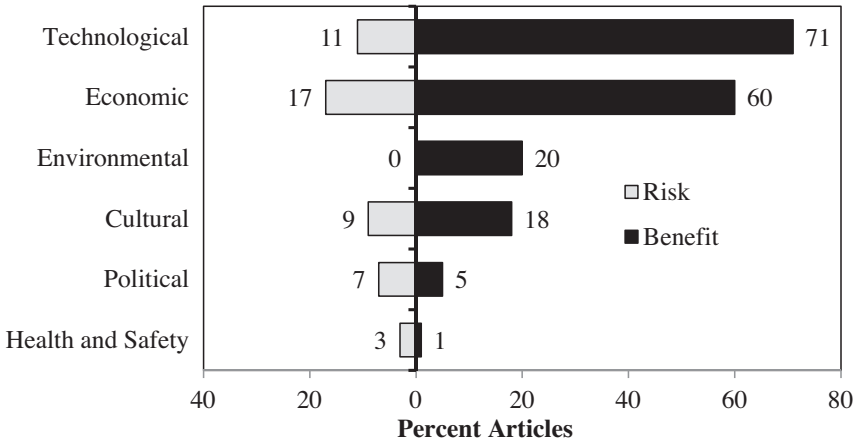

Figure 5: Percent of Articles that Mention Each of the Six SPEED Risk and Benefit Frames from 1998 to 2012
A similar distribution of SPEED frames was found in all newspapers.

other emerging energy technologies including wind and carbon capture and storage (Feldpausch-Parker et al., 2013; Chaudhry et al., 2013; Fischlein et al., 2010). The minimal political framing may reflect the low level of political salience of basic infrastructure or the lack of policy development for SG. Technical benefits of SG are mentioned in more than 70 percent of articles and economic benefits in 60 percent. More than 20 percent of articles also frame environmental benefits. The benefit to risk ratio is approx. 6:1 for technological frames and 3:1 for economic frames. Cultural benefits, like behavioral change, are represented in twice as many articles as cultural risks, indicating that the positive role and impacts of SG for electricity users has received more attention than potential negative impacts.

Concerns about privacy are among the most frequent

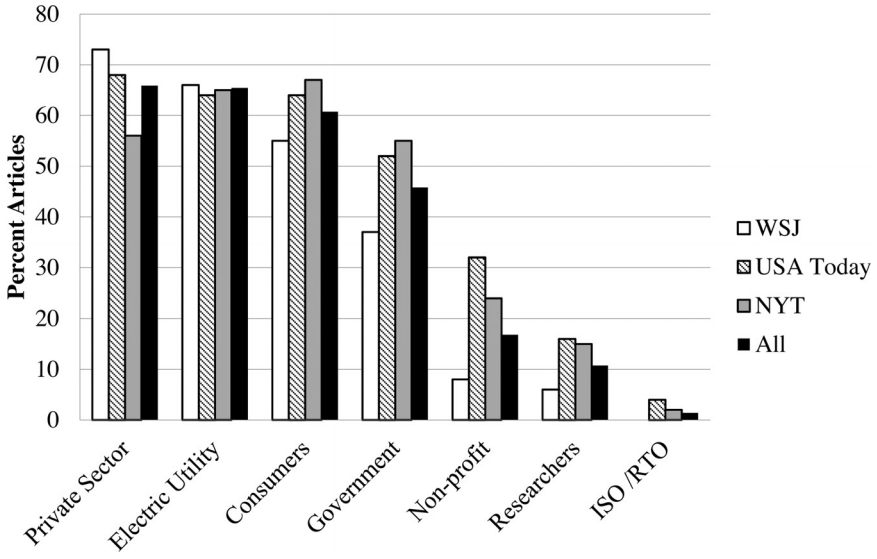

Figure 6: Percent of Articles from 1998 to 2012 that Mention Specific Stakeholders/Actor Groups

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cultural risks mentioned as demonstrated in this example from the *NYT*:

> Before long, the meters in our homes will be able to measure electricity usage down to the level of individual air conditioners, plug-in cars and microwave ovens. That data is potentially valuable, and it may reveal more about customers than they want to disclose. (Greising, 2011, p. 27A)

Mistrust about how electricity data might be used and what private details this data could reveal represents a powerful negative cultural association. Cultural benefit associated with SG include mentions of how information provided through SG technologies can change energy use and increase an individual's ability to manage their electric bill as demonstrated in this examples from the *WSJ*:

> Seeing that her consumption rose when she turned on her electric oven to heat up an individual pizza for lunch, she bought a toaster oven and now uses it or her microwave as much as possible. (Gold, 2011, p.R7)

D. Key actors in smart grid discourse

The articles present many societal actors as influential and involved in SG development (**Figure 6**). The private sector is mentioned the most, particularly in the *WSJ*. University/academic representatives and system operators are mentioned in less than 10 percent of all articles, while regional transmission organizations, which plan and manage the bulk power grid, are largely absent from these public conversations.

V. Conclusions

Policies promoting SG have spurred media coverage and

public discourse; media attention began within the past five years with a distinct peak in media coverage after the 2008 ARRA investments. SG coverage is found in many different newspaper sections demonstrating the breadth of SG relevance to multiple actors. SG discourse after 2010 decreased, possibly attributed to reduced novelty of the SG concept and reduced news-worthiness as smart meter installations become more commonplace.

Among these three national-level newspapers, SG coverage the *WSJ* focused more on economic framing, reflecting its business angle and the financial significance of SG development. Despite the important role of government and civil society in SG policy and development, the *WSJ* did not often mention these actors and tended to concentrate its coverage on the private sector. Many of the articles on SG were triggered by smart meter installations; the *NYT* had the largest percentage (over 40 percent) of all SG articles mentioning smart meter installations. *USA Today* had the fewest SG articles, but most of the *USA Today* articles attempted to present a broader and more comprehensive SG story than was presented in many of the *WSJ* articles which often were reporting on a specific project or initiative. More SG articles were placed in the Business and Finance section than any other section, highlighting the important business opportunities associated with SG development. The financial focus also suggests a perceived potential of SG to influence costs and revenues of existing industries and to connect with enabling technologies like the smart meter, and future technologies like electric cars and energy storage technologies (Brown and Zhou, 2012).

Analysis of the SG media discourse highlights the sociopolitical complexity of SG systems, as the term does not represent a single technology, but system-wide change involving multiple actors and interacting technologies and policies. The breadth of technologies

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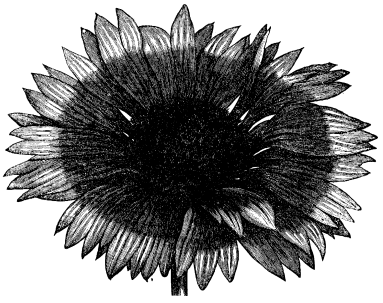
mentioned within the SG term is both an asset and a limitation. While SG includes multiple components of electricity system innovation and allows multiple actors to participate, the lack of clarity on what SG means creates ambiguity for individuals, communities, and policymakers. For some key actors, this ambiguity is a challenge that reduces their use of the ''smart grid'' language.

Smart meters are the dominant technology associated with SG, but not all SG articles explicitly mention smart meters. This analysis demonstrates how the media coverage of SG simultaneously encompasses a list of different technologies and sub-sets of specific technologies and highlights how different actors view SG from different perspectives.

The higher frequency of positive rather than negative framing of SG represents the multiple potential benefits associated with SG and the optimistic technological perspective that is dominant in mainstream media in the U.S. (Basiago, 1994). Technological and economic SPEED frames have a much higher prevalence across the three newspapers than environmental, health & safety, or political framing, suggesting that public discourse in newspaper coverage about SG is similar to discourse of other technologies where the technological and economic SPEED frames dominate (Feldpausch-Parker et al., 2013; Stephens et al., 2009).

This research demonstrates that the complex nature of SG media coverage arises from both multiple technological changes and social changes. A diverse set of actors will engage with, build, regulate and operate future electricity systems, and electricity system innovation is being



shaped by complex socio-political contexts. SG policies and investments across multiple levels (local, state, regional, and national) are likely to expand, so understanding the social dynamics of the discourse analyzed through public conversations in the mainstream media, provides important insights on the pace and direction of electricity system change informing current and future SG development.■

References

Aldy, J., 2011. A Preliminary Review of the American Recovery and Reinvestment Act's Clean Energy Package. In: HKS Faculty Research Working Paper Series RWP11-048.

Alliance for Audited Media, 2013. Top 25 U.S. Newspapers for March 2013.

Amin, M.S., Gellings, C.W., 2006. The North American power delivery system: balancing market restructuring and environmental economics with infrastructure security. Energy 31 (6/7) 967–999.

Basiago, A.D., 1994. The limits of technological optimism. Environmentalist 14 (1) 17–22.

Beyea, J., 2010. The smart electricity grid and scientific research. Science 328 (5981) 979–980.

Boyd, A.D., et al., 2013. Controversy in technology innovation: contrasting media and expert risk perception of the alleged leakage at the weyburn carbon dioxide storage demonstration project. Int. J. Greenhouse Gas Control 14, 259–269.

Brown, M.A., Zhou, S., 2012. Smart-grid policies: An international review. WIREs Energy Environ. 2 (2) 121–139.

Chaudhry, R., et al., 2013. Policy stakeholders' perceptions of carbon capture and storage (CCS): a comparison of four U.S. states. J. Clean. Prod. 52, 21–32.

Cohen, J., 1988. Statistical Power Analysis for the Behavioral Sciences. Lawrence Erlbaum Associates, Hillsdale NJ.

DoE, 2010. Budget Information, http://www.oe.energy.gov/budget.htm (accessed 26.07.10).

Dunwoody, S., Neuwirth, K., 1991. Coming to terms with the impact of communication on scientific and technological risk judgments. In: Wilkins, L., Patterson, P. (Eds.), Risky Business: Communicating Issues of Science, Risk and Public Policy. Greenwood Press, Westport, CT, pp. 11–30.

EPRI, 2011. Estimating the Costs and Benefits of the Smart Grid: A Preliminary Estimate of the Investment Requirements and the Resultant Benefits of a Fully Functioning Smart Grid. EPRI, Palo Alto, CA.

Feldpausch-Parker, A.M., et al., 2013. Spreading the news on carbon capture and storage: a state-level media comparison. Environ. Commun. 7 (3) 336–354.

Fialka, J.J., 2007. Austin Power: In Quest for Cleaner Energy, Texas

http://dx.doi.org/10.1016/j.tej.2014.05.008

City Touts Plug-In Car Mayor's Unusual Plan Links Wind, Batteries; Pitching Auto Makers. The Wall Street Journal 26 Mar. 2007.
Fischlein, M., et al., 2010. Policy stakeholders and deployment of wind power in the sub-national context: a comparison of four U.S. states. Energy Policy 38, 4429–4439.
Fischlein, M., et al., in press. Which way does the wind blow? Analyzing the sub-national context for renewable energy deployment in the United States. Environ. Policy Govern., http://dx.doi.org/10.1002/eet.1636.
Gamson, W.A., Modigliani, A., 1989. Media discourse and public opinion on nuclear power: a constructionist approach. Am. J. Sociol. 95 (1) 1–37.
Gold, R., 2011. Innovations: Energy (a Special Report) The Power of Knowledge: With New Monitors, Homeowners Can Keep Track of their Electricity Use in Real Time; It Can Make All the Difference. The Wall Street Journal Feb. 28, 2011, p. R7.
Graber, D.A., 1997. Mass Media and American Politics. CQ Press, Washington, DC.
Gregory, R., 1989. Improving risk communications: questions of content and intent. In: Leiss, W. (Ed.), Prospects and Problems in Risk Communication. University of Waterloo Press, Waterloo, pp. 71–80.
Greising, D., 2011. Promise and Peril in Utilities' Smart Grid. New York Times May 29, 2011 p. 27A.
Hair, J.E.A., 2006. Multivariate Data Analysis, 6th ed. Pearson-Prentice Hall, New York.
Hansen, A., 1991. The media and the social construction of the environment. Media Cult. Soc 13, 443–458.
Hess, D.J., 2013. Smart Meters and Public Acceptance: Comparative Analysis and Design Implications. In: Paper Presented at the Meeting of the Sustainable Consumption Research and Action Network, Clark University, Jun. 12–14, Worcester, Massachusetts.
Investors Business Daily, 2010. Smart Grid Push Hits Gridlock as Consumers, Regulators Rebel. Investors Business Daily p. Jul. 2010.
Levinson, M., 2010. Is the smart grid really a smart idea? Iss. Sci. Technol. 27 (1) 39–48.
Luhmann, N., 1989. Ecological Communication. University of Chicago Press, Chicago, IL.
Luhmann, N., 1995. Social Systems. Stanford University Press, Stanford, CA (Translated by J. Bednarz, Jr. from Soziale Systeme: GrundriBeiner allgeneinen Theorie. Frankfurt am Main: Suhrkamp, 1984).
McCombs, M., 2002. The agenda-setting role of the mass media in the

shaping of public opinion. In: Mass Media Economics 2002 Conference, London School of Economics.
McCombs, M.E., 2004. Setting the Agenda: The Mass Media and Public Opinion. Polity Press, Cambridge, UK.
Minnesota Dept. of Employment & Economic Development, 2010. Environment and Energy Programs: Smart Grid, http://www.positivelyminnesota.com/Business/Exporting_Trade/Export_Education_Training/Environmental_Energy_Programs_3.aspx (accessed 27.07.10).
Murray, D., Schwartz, J., Lichter, S.R., 2001. It Ain't Necessarily So: How Media Make and Unmake the Scientific Picture of Reality. Rowman & Littlefield Publishers, Inc., Lanham, MD
PR News Wire, 2010. Industry and Local Government Leaders Create Silicon Valley Smart Grid Task Force, http://www.examiner.com/p-476592~Industry_and_Local_Government_Leaders_Create_Silicon_Valley_Smart_Grid_Task_Force.html (accessed 26.07.10).
Singer, E.T., Endreny, P.M., 1987. Reporting hazards: their benefits and costs. J. Commun. 37 (3) 10–26.
SmartGrid.Gov. Administration Announces Grid Modernization Initiatives to Foster a Clean Energy Economy and Spur Innovation. http://www.smartgrid.gov/recovery_act/deployment_status/ami_and_customer_systems##SmartMetersDeployed 2013; Available from: http://www.smartgrid.gov/news/administration_announces_grid_modernization_initiatives_foster_clean_energy_economy_and_spur__0#sthash.cYmBydWN.dpuf.
Stephens, J.C., Wilson, E.J., Peterson, T.R., 2008. Socio-political Evaluation of Energy Deployment (SPEED): an integrated research framework analyzing energy technology deployment. Technol. Forecast. Soc. Change 75, 1224–1246.
Stephens, J.C., Rand, G.M., Melnick, L.L., 2009. Wind energy in the U.S. media: a comparative state-level analysis of a critical climate change mitigation technology. Environ. Commun.: J. Nat. Cult. 3 (2) 168–190.
Stephens, J.C., et al., 2013. Getting smart? Climate change and the electric grid. Challenges 4 (2) 201–216.
Wald, M.L., 2013. Ideas to Bolster Power Grid Run Up Against the System's Many Owners. New York Times.
Wilson, E.J., Stephens, J.C., 2009. Wind deployment in the United States: states, resources, policy, and discourse. Environ. Sci. Technol. 43 (24) 9063–9070.

Endnote:

1. Analysis of technologies, actors, and the SPEED frames was conducted on all articles except for the 17 articles published in 2013 articles.

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