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Peak Oil Theory in Canada's *Globe and Mail*: A Case Study of the Construction of Ignorance

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See table of contents

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Article abstract

Scientific knowledge is essential to understand problems confronting society, and the mass media have become the main source of this knowledge for most people. However, the mass media filter scientific information, leading sometimes to what has been termed "the construction of ignorance." This article offers a case study of this process. It explains how Canada's leading newspaper, the *Globe and Mail*, has depicted oil depletion theory (or "peak oil" theory). By contrasting the history of oil depletion theory with its representation in the *Globe and Mail* since the turn of the millennium, the article reveals the contours of this constructed ignorance. Comparison with coverage of meteorological and climate change science further refines the analysis. Finally, the article investigates the underlying causes for the *Globe and Mail*'s treatment of peak oil theory and how it relates to the Canadian context.

Peak Oil Theory in Canada's *Globe and Mail*: A Case Study of the Construction of Ignorance[1]

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Abstract : Scientific knowledge is essential to understand problems confronting society, and the mass media have become the main source of this knowledge for most people. However, the mass media filter scientific information, leading sometimes to what has been termed "the construction of ignorance." This article offers a case study of this process. It explains how Canada's leading newspaper, the *Globe and Mail*, has depicted oil depletion theory (or "peak oil" theory). By contrasting the history of oil depletion theory with its representation in the *Globe and Mail* since the turn of the millennium, the article reveals the contours of this constructed ignorance. Comparison with coverage of meteorological and climate change science further refines the analysis. Finally, the article investigates the underlying causes for the *Globe and Mail*'s treatment of peak oil theory and how it relates to the Canadian context.

Résumé : Les connaissances scientifiques sont essentielles pour comprendre des problèmes qui affectent la société, et les médias sont devenus, pour la plupart des gens, la source principale de ces connaissances. Cependant, les médias filtrent les informations scientifiques, menant parfois à ce qu'on appelle « la construction de l'ignorance ». Cet article offre une étude de cas de ce processus. Il explique comment le principal quotidien du Canada, le *Globe and Mail*, a dépeint la théorie de l'épuisement du pétrole (dite théorie du pic pétrolier). En comparant l'histoire de la théorie de l'épuisement du pétrole avec sa représentation dans le *Globe and Mail* depuis le tournant du millénaire, l'article révèle les contours de cette ignorance fabriquée. Une comparaison avec les représentations des sciences de la météorologie et du changement climatique affine l'analyse. Finalement, l'article explore les causes sous-jacentes du traitement de la théorie du pic pétrolier par le *Globe and Mail* et leurs rapports avec le contexte canadien.

1. The author thanks Muhamed Amin, James Morgan, Sean Nicklin, and Jonathan Ruano for critiquing an earlier draft of this paper. Nader Fakih provided research assistance. Dr. Raymond J. Price and J. David Hughes helpfully responded to research questions. Thanks also to Kouky Fianu for help in translating the abstract into French.

> "Who knows not? And why not? Where is there ignorance and why? Like knowledge or wealth or poverty, ignorance has a face, a house, and a price . . . It is less like a vacuum than a solid or shifting body—which travels through time and occupies space, runs roughshod over people or things, and often leaves a shadow."[2]

People today get most of their knowledge of science from the mass media,[3] but much is "lost in translation." By choosing which topics, facts, and opinions to convey as information, by organizing and presenting this information in specific ways, and by repeating the process through time, the mass media construct particular understandings of science. More broadly, the mass media have established a distinct system of cognition, with its own coherence, epistemologies, methodologies, and uses, which shapes the way scientific knowledge is portrayed and diffused.[4] The present article explores a significant example of mass media representation of science. It analyzes how "peak oil" theory has been filtered through the pages of Canada's leading newspaper, the *Globe and Mail*. It traces and seeks to account for the representation that has resulted and how it relates to Canadian circumstances. I argue that the *Globe and Mail's* coverage of peak oil is a case of "cultural production of ignorance,"[5] which in turn has obscured the theory's value as a tool for developing long-term energy policy.

The term "peak oil" is a neologism of the 21st century.[6] The expression used to be part of a longer phrase, "peak oil production," which referred to the maximum rate of output of an oil field during its lifespan. When graphed as a production curve measured over time, the rate of output of an

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2. Robert N. Proctor, "Agnotology: A Missing Term to Describe the Cultural Production of Ignorance," in *Agnotology: The Making and Unmaking of Ignorance*, eds. Robert N. Proctor and Linda Schiebinger (Stanford: Stanford University Press, 2008), 6-7.

3. Mike S. Schafer, "Taking Stock: A Meta-Analysis of Studies on the Media's Coverage of Science," *Public Understanding of Science* 21, 6 (2012): 650-663.

4 Niklas Luhmann, *The Reality of the Mass Media.* Translated by Kathleen Cross (Stanford: Stanford University Press, 2000). Luhmann, a German sociologist and systems theorist, analyzes the mass media as an autopoietic system that constructs specific understandings of the world based on its choices over time of what constitutes "news" and "information" to be reported. Interpreting Luhmann's ideas, Stehr and Beckmann observe that "the mass media do not present an image of a reality that they have distinguished (this cannot actually be their function), but rather they themselves create the reality which they communicate daily as news, reports, advertising. Although this reality is a manufactured reality that arises selectively—and we are aware of this—it is the socially relevant one, and retains its validity while giving us a view of genuine reality, if we understand how this is produced, constructed and consumed." See Gotthard Bechmann and Nico Stehr, "Niklas Luhmann's Theory of the Mass Media," *Society* 48, 2 (2011): 142.

5. Proctor, "Agnotology," 6.

6. The *Globe and Mail* never used the term "peak oil" as a stand-alone expression in the 20th century, but it appears over 300 times from 2000 through 2014. In the news database, Factiva, "peak oil" also emerges as a standalone expression only in the early 21st century.

oil field starts from zero, rises to one or more peaks, and eventually declines again, ultimately back to zero when the field is taken out of production.[7] Over the 20th century, the phrase "peak oil production" was increasingly applied not only at the level of oil fields, but also at regional, national, and global levels, the idea being that production curves comprising many oil fields could be charted, all the way up to the global level. Around the dawn of the 21st century, "peak oil" began to be used in a new way, as a standalone phrase, with two new meanings. First, it began to be conceptualized as an *event*—the date or time period when the rate of oil production of the world (or of a nation) would reach its peak, as in "When will the world reach peak oil?" Second, it began to refer to the phenomenon of oil depletion in its multifarious aspects. This meaning of the term emerged notably with the founding, in 2001, of the Association for the Study of Peak Oil, which brought together professionals from universities, government, international organizations, and the oil industry to discuss and exchange theoretical and empirical knowledge about oil depletion and its larger ramifications. In this sense, "peak oil" began to refer to the domain of scientific inquiry concerned with patterns and dynamics of oil discovery, production, and depletion, an area of research extending back to the early decades of the 20th century, which was rooted in oil industry practice.[8]

Understood either as a field of scientific inquiry or as a problem facing contemporary society, peak oil transcends the national level, yet there are several reasons why it specifically matters for Canada. First, as one of the largest, coldest, and most thinly populated countries in the world, availability of oil matters for Canada's future.[9] For example, Canada's large size and low population density make transportation a crucial issue, and 95% of transport today is powered by energy derived from oil.[10] More generally, Canada's per capita energy consumption is among the highest in the world, exceeding that of the United States and all Arctic nations except Iceland,[11] and nearly 43% of this energy comes from oil, with a

7. Fields that have stopped producing will always contain some remaining oil, but either it is no longer accessible with available technology or economic conditions make recovery unprofitable.

8. These conclusions are based on analysis of how the term has been used in newspapers, using the Factiva database, and by tracking usage of the term by date through "Google Scholar."

9. Concerns about oil depletion have accordingly been a theme in *Globe and Mail* news coverage since the 1940s.

10. Oil dominates the transport sector because it has a higher energy density than other sources, and its liquid form makes it easier to store and transport than, e.g., coal. In shipping for example, coal gave way to oil in part because the latter took up far less storage space for a given energy output, required less labor, was cleaner, etc.

11. See the international energy statistics of the authoritative U.S. Energy Information Administration (EIA) at:

further 31.5% from natural gas, both non-renewable resources.[12] Second, peak oil matters for Canada because it matters for the United States. The two countries are joined at the hip when it comes to energy. American firms built Canada's oil industry,[13] and much of the oil produced in Canada has been consumed in the United States.[14] The two nations have an integrated energy system characterized by large net flows of oil and gas (and hydropower) from Canada to the U.S. The scale of these flows is enormous. Globally, the U.S. is by far the world's largest consumer of oil and gas,[15] and Canada has become America's single largest external supplier of both.[16] Concerns about global peak oil thus necessarily implicate Canada. Third, as will be shown in this article, peak oil is directly linked to Canada's self-proclaimed rise to the status of "emerging energy superpower," a term introduced by Prime Minister Stephen Harper in 2006.[17]

In studying peak oil in the Canadian mass media, I have chosen to focus on a single newspaper, the *Globe and Mail*. Being printed records, newspapers are relatively efficient to use and search. In addition, they generally track issues more systematically and in greater depth than TV or radio news broadcasts. The *Globe and Mail* was selected because it is Canada's leading "newspaper of record," having earned this designation precisely because of its thorough coverage of national and international news and because of its consistent following of major economic and intellectual trends and debates. The *Globe and Mail* is, moreover, Canada's premier business newspaper, offering extensive coverage of the energy sector. Its coverage of peak oil is more extensive than that of the

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http://www.eia.gov/cfapps/ipdbproject/iedindex3.cfm?tid=44&pid=45&aid=2&cid=regions&syid=2005&eyid=2011&unit=MBTUPP, accessed 7 January 2015.

12. Oil and gas are closely related with respect to their formation and geological location, and the broad phenomenon that is termed "peak oil" also applies to natural gas. That is, gas production output curves are similar to those for oil, and both can and have been analyzed at field levels and at national and global levels. Because a large portion of natural gas production is not liquid, however, it cannot be shipped globally as easily as oil, so natural gas markets are less globally integrated than those of oil.

13. Sandy Gow, *Roughnecks, Rock Bits, and Rigs: The Evolution of Oil Well Drilling in Alberta, 1883-1970* (Calgary: University of Calgary Press, 2005), 54-62.

14. Today Canada exports 2/3 of its domestic oil production, almost all to the United States. See: http://www.nrcan.gc.ca/energy/fuel-prices/4597, accessed 24 January 2015.

15. Oil consumption data can be found at: http://www.eia.gov/countries/index.cfm?topL=con, accessed 24 January 2014; and gas consumption data can be found at: https://www.cia.gov/library/publications/the-world-factbook/rankorder/2250rank.html, accessed 24 January 2015.

16. For oil imports to U.S. by country of origin, see: http://www.eia.gov/dnav/pet/pet_move_impcus_a2_nus_ep00_im0_mbbl_a.htm, accessed 24 January 2015. Natural gas imports to the U.S. by country of origin can be found at: http://www.eia.gov/dnav/ng/ng_move_impc_s1_a.htm, accessed 24 January 2015.

17 Jane Taber, "PM Brands Canada Energy Superpower," *Globe and Mail*, 15 July 2006, A1.

New York Times or the *Wall Street Journal*. Between 2000 and the end of 2014, according to statistics from the news database *Factiva*, the phrase "peak oil" appeared 301 times in the *Globe and Mail,* 187 times in the *Wall Street Journal*, and 104 times in the *New York Times*. Analysis of the articles containing the term "peak oil" in each newspaper (sorted by relevance) confirms that the subject has been treated in greater depth and variety in the *Globe and Mail* than in the other two newspapers.[18] For example, a leading pioneer of peak oil theory, American geophysicist Marion King Hubbert, was mentioned 21 times in the *Globe and Mail* between 2000 and the end of 2014, but only 11 times in the *Wall Street Journal* and 4 times in the *New York Times*.

Scholarly interest in media coverage of science has grown rapidly over the past two decades because, on the one hand, the mass media are a primary source of knowledge about science, and on the other hand, many serious problems confronting society today are bound up with scientific knowledge,[19] climate change being a well-known example.[20] My approach combines theories and methods from media studies[21] and history of

18. The *Globe and Mail*'s more extended coverage of peak oil relative to the *Wall Street Journal* and *New York Times* may reflect the comparative importance of the oil sector for the Canadian economy and its export profile.

19. The subject of science and mass media is a principal focus of the journals *Public Understanding of Science* and *Science Communication*. See also the *Routledge Handbook of Public Communication of Science and Technology*, eds. Massimiano Bucchi and Brian Trench, which is now in its second edition (London: Routledge, 2014). A recent survey of the field has been published by Mike S. Schäfer, "Sources, Characteristics and Effects of Mass Media Communication on Science: a Review of the Literature, Current Trends and Areas for Future Research," *Sociology Compass* 5, 6 (2011): 399-412. For a recent overview of this field in a Canadian context, see Bernard Schiele and Anik Landry, "The Development of Science Communication Studies in Canada," in *Science Communication in the World*, eds. Bernard Schiele, Michel Claessens and Shunke Shi (New York and Dordrecht: Springer, 2012), 33-63.

20. There are too many studies about public understanding of climate change and its coverage by the mass media to list here. Some important examples include Naomi Oreskes and Erik M. Conway, *Merchants of Doubt: How a Handful of Scientists Obscured the Truth on Issues from Tobacco Smoke to Global Warming* (New York: Bloomsbury Press, 2010); Maxwell T. Boykoff, *Who Speaks for the Climate? Making Sense of Media Reporting on Climate Change* (Cambridge: Cambridge University Press, 2011); Peter Weingart, Anita Engels, and Petra Pansegrau, "Risks of Communication: Discourses on Climate Change in Science, Politics, and the Mass Media," *Public Understanding of Science* 9, 3 (2000): 261-283; Anabela Carvalho and Jacquelin Burgess, "Cultural Circuits of Climate Change in UK Broadsheet Newspapers, 1985–2003," *Risk Analysis* 25, 6 (2005): 1457-1469; Liisa Antilla, "Climate of Scepticism: US Newspaper Coverage of the Science of Climate Change," *Global Environmental Change* 15, 4 (2005): 338-352.

21. The work of Luhmann, cited in note 3, is fundamental, as is Edward S. Herman and Noam Chomsky, *Manufacturing Consent: The Political Economy of the Mass Media* (New York: Pantheon, 1988). The impact of the latter study is surveyed in Andrew Mullen and Jeffery Klaehn, "The Herman–Chomsky Propaganda Model: A Critical Approach to Analysing Mass Media Behaviour," *Sociology Compass* 4, 4 (2010): 215–229. Media

science. It takes up Ken Alder's recent call to historians of science to show, not just how science matters, but how its *history* matters.[22] I do so by showing how a long-term historical understanding of oil depletion theory (covering a century) can help to assess the *Globe and Mail's* representation of peak oil in ways that media studies techniques alone cannot. My approach contributes to the study of "agnotology," defined by historian of science Robert N. Proctor as the study of "the cultural production of ignorance."[23] Combining historical analysis of oil depletion theory with examination of its representation in a major newspaper makes it possible to delineate the contours of ignorance of this body of science as represented in the *Globe and Mail*, and helps to gain a better understanding of their causes. Dozens of books and articles about peak oil have been written by practicing journalists, activists, economists, energy policy analysts, scientists, and engineers, from which I have drawn many crucial insights.[24] Yet as a group, these contributions are weak with regard

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scholars have also developed a tool kit of practical methodologies, such as studying how mass media engage in "agenda setting" through their choices of what to publish as news, how they engage in "framing" through their choices of how to present that news, and how they apply the concept of "balance."

22. Ken Alder, "The History of Science as Oxymoron: From Scientific Exceptionalism to Epiſcience," *Isis* 104, 1 (2013): 88-101.

23. Proctor, "Agnotology," 1-33. Proctor's agnotology builds on growing interest in the "sociology of scientific ignorance." This trend is discussed in a case study by S. Holly Stocking and Lisa W. Holstein, "Manufacturing Doubt: Journalists' Roles and the Construction of Ignorance in a Scientific Controversy," *Public Understanding of Science* 18, 1 (2009): 23-42. See also Steve Rayner, "Uncomfortable Knowledge: the Social Construction of Ignorance in Science and Environmental Policy Discourses," *Economy and Society* 41, 1 (2012): 107-125.

24. See, e.g. Colin J. Campbell, *The Coming Oil Crisis* (Brentwood, Essex, England: Multi-Science Publishing Co. & Petroconsultants, 1988); Kenneth S. Deffeyes, *Hubbert's Peak: The Impending World Oil Shortage* (Princeton: Princeton University Press, 2001); Matthew R. Simmons, *Twilight in the Desert: The Coming Saudi Oil Shock and the World Economy* (Hoboken, N.J.: John Wiley & Sons, 2005); David L. Goodstein, *Out of Gas: the End of the Age of Oil* (New York: Norton, 2005); and Jeremy Leggett, *Half Gone: Oil, Gas, Hot Air and the Global Energy Crisis* (London: Portobello Books, 2005); Richard Heinberg, *The Party's Over: Oil, War and the Fate of Industrial Societies* (Gabriola Island, BC: New Society, 2003); and James Howard Kuntsler, *The Long Emergency: Surviving the End of Oil, Climate Change, and Other Converging Catastrophes of the Twenty-First Century* (New York: Grove Press, 2006); Ugo Bardi, "Peak Oil: The Four Stages of a New Idea," *Energy* 34, 3 (2009): 323-326; Charles A.S. Hall and Kent A. Klitgaard, *Energy and the Wealth of Nations: Understanding the Biophysical Economy* (New York and Dordrecht: Springer, 2012); Charles Hall and Carlos A. Ramírez-Pascualli, *The First Half of the Age of Oil: an Exploration of the Work of Colin Campbell and Jean Laherrère* (New York and Dordrecht: Springer, 2012); and Kjell Aleklett, Michael Lardelli, and Olle Qvennerstedt, *Peeking at Peak Oil* (New York: Springer, 2012). Some Canadian examples are Jeffrey Rubin*, Why Your World Is About to Get a Whole Lot Smaller: Oil and the End of Globalization* (New York: Random House, 2009); Jeffrey Rubin, *The Big Flatline: Oil and the No-Growth Economy* (New York: Palgrave Macmillan, 2012); Thomas Homer-

to both historical methodology and media theory. They do not explore the long-term history of peak oil theory, and very few consider the mass media's coverage of this topic. In short, no existing study of peak oil has covered the terrain surveyed here.[25]

Historical Overview of Oil Depletion Theory

A crucial factor in the *Globe and Mail's* coverage of peak oil pertains to the meaning given to the term "theory." This word can be used in two quite different ways. It can refer simply to a hypothesis put forward to explain some phenomenon or trend. Alternately, it can mean a body of methodologies, theoretical analysis, and research results intended to model and analyze a range of empirical phenomena, which have been built up over a period of time and have gained acceptance within a professional community. Quantum mechanics, theory of elasticity, and probability theory fit this definition, as does climate change science. Although theories in this broader sense may involve disputes among practitioners, they are not generally overturned until some alternate framework has been established that models and accounts for the phenomena under question equally well or better.[26]

The *Globe and Mail* has portrayed peak oil in the first sense: as a controversial hypothesis and the focus of a dispute between those who believe it and those who don't.[27] Readers of the *Globe and Mail* were first introduced to the dispute—and to the term "peak oil"—in an article in May 2004, which explained:

Dixon, ed., *Carbon Shift: How the Twin Crises of Oil Depletion and Climate Change Will Define the Future* (Toronto: Random House Canada, 2009).

25. Most peak oil studies understandably have other priorities than historical analysis or media theory. However, historians and sociologists of science have begun to study aspects of the history of peak oil theory. See, notably, Gary Bowden, "The Social Construction of Validity in Estimates of US Crude Oil Reserves," *Social Studies of Science* 15, 2 (1985): 207-240; and Tyler Priest, "Hubbert's Peak: The Great Debate over the End of Oil," *Historical Studies in the Natural Sciences* 44, 1 (2014): 37-79. An analysis of concerns about coal depletion is Nuno Luis Madureira, "The Anxiety of Abundance: William Stanley Jevons and Coal Scarcity in the Nineteenth Century," *Environment and History* 18, 3 (2012): 395-421. On the media studies side, interest in the peak oil issue is also growing. See Susanne Becken, "Oil Depletion or a Market Problem? A Framing Analysis of Peak Oil in The Economist News Magazine," *Energy Research & Social Science* 2 (2014): 125-134; and Aleksandra Wagner, "Shale Gas: Energy Innovation in a (Non-) Knowledge Society: A Press Discourse Analysis," *Science and Public Policy* (2014):1-14, accessed 15 October 2014, doi: 10.1093/scipol/scu050.

26. The classic analysis of theory change in science is Thomas S. Kuhn, *The Structure of Scientific Revolutions* (Chicago: University of Chicago Press, 1962).

27. This conclusion is based on reading all *Globe and Mail* articles with the term "peak oil" (all after 2000).

> Industry magazines have been tracking a controversy about "peak oil"... Pessimists in this controversy, mostly geologists, are impressed that oil discoveries peaked worldwide in 1960, and have been running well below extraction levels since the early 1980s. On the other side, the optimists, mostly economists, believe human ingenuity can postpone the peak in oil production, perhaps indefinitely.[28]

The presumed nature of the peak-oil hypothesis varied between journalists, but none gave it more than a sentence or two of explanation. For one it was "the notion that world oil production will soon outstrip demand. [sic]"[29] For another it was the view that "supplies of oil are running out and prices will grow prohibitively high and civilization will change dramatically."[30] Journalist Patrick Brethour associated peak oil with the view that "the world is on the brink of a catastrophic drop in crude production."[31] In contrast, journalist Eric Reguly associated peak oil with the view that global oil production would enter "a slow but irreversible decline."[32] In another instance, Brethour described peak oil not even as a hypothesis, but merely as "the *worry* that oil supplies will start to decline sharply in the immediate future" [my italics].[33] Brethour offset this worry by citing an expert who quipped that peak oil was just "a fashion. It comes every 10 years when we have high prices."[34]

Historical analysis shows that peak oil is not merely a controversial or fashionable hypothesis, but is, in fact, a large and well-established body of theory in the broader sense of the term. Oil depletion theory has developed over roughly a century. It encompasses many thousands of pages of peer-reviewed research results, utilizes widely accepted methodologies, and has been applied in practical ways by oil industry specialists from the early 20th century up to the present. Historical analysis shows that oil depletion theory has raised controversy but has not been overturned. On the contrary, its depth, breadth, reach, and influence have continually expanded. Indeed, it will be shown that even leading experts who are portrayed by the *Globe and Mail* as opposing peak oil actually work within its framework.

Peak oil theory models and analyzes the phenomenon of oil depletion. Petroleum is a finite resource and is defined as non-renewable because it

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28. Richard Gilbert, "Don't Gripe About Gas Prices," *Globe and Mail*, 11 May 2004, A23.
29. Ibid. The sentence should have expressed the very different idea that oil production would no longer be able to increase to meet growing demand.
30. Russell Smith, "Language: New Coinages," *Globe and Mail*, 19 February 2009, R1.
31. Patrick Brethour, "Energy: There's Still Lots of Oil—at a Price: IEA Agency Warns West...," *Globe and Mail*, 8 November 2005, B11.
32. Eric Reguly, "A Penny for Investors' Thoughts," *Globe and Mail*, 27 December 2005, B2.
33. Patrick Brethour, "Only Conservation Efforts Will Keep a Lid on Energy Costs: IEA; Rise in Oil Sands Output Helping for Now," *Globe and Mail*, 3 December 2005, B6.
34. Ibid. The expert quoted was Chief Economist of the International Energy Agency (IEA), Fatih Birol.

forms at such an exceedingly slow rate that its quantity is essentially fixed and unchanging relative to the rate at which humans use it. Oil originated from decaying plant matter and microscopic organisms through a process spanning hundreds of millions of years,[35] but humans use it at rates that are many orders of magnitude higher. To give a telling example, the oil consumed globally each year is equivalent to more than 400 times the energy embodied in all the plant life on Earth.[36] Depletion is a fundamental material and economic fact of the oil business. Exploitation of an oil property progressively diminishes its investment value, as the oil within it is removed. Because of this reality, oil came to be referred to as a "wasting asset" and, up until the oil crisis of the 1970s, American and Canadian oil firms were allowed a tax deduction, known as an oil depletion allowance, to offset the declining values of oil properties that occurred as this "wasting asset" was progressively removed.[37] Oil, unlike gold and other metals, also ceases to exist in a useable form once it is burned.

The fact of depletion led oil companies and other interested parties to track production and decline rates of wells and fields over time in order to estimate their future performance for the purposes of investment, taxation, and valuation of the worth of oil properties and oil companies. For example, a potential investor in a producing oil property needed to know how much oil remained to be recovered and the rate at which this oil could be extracted in the future, since the return on investment depended on these numbers. To develop such knowledge, engineers and geophysicists linked to the oil industry, or to government agencies concerned with this sector, began to study oil production and decline curves, to compare these curves between fields and geological areas, and to determine whether and how these curves could be modeled mathematically so as to estimate future production and decline rates. Already by 1924, we find a paper reviewing developments in oil production curve analysis that had occurred over the preceding decade. The review article noted that such production curves had been "used for many years by various engineers and oil companies."[38] One of the papers

35. Oil basins (ancient seas) cover less than 8% of the world's surface, and oil formed in them only where a specific set of conditions was met. See Kurt Bucher and Rodney Grapes, *Petrogenesis of Metamorphic Rocks* (New York and Dordrecht: Springer, 2011), 24; Deffeyes, *Hubbert's Peak*, 8-10, 14-69.

36. See Jeffrey S. Dukes, "Burning Buried Sunshine: Human Consumption of Ancient Solar Energy," *Climatic Change* 61 (2003): 31.

37. Depletion allowances also existed for other minerals. The history of the oil depletion allowance in the U.S. is covered in Peter A. Shulman, "The Making of a Tax Break: The Oil Depletion Allowance, Scientific Taxation, and Natural Resources Policy in the Early Twentieth Century," *Journal of Policy History* 23, 3 (2011): 281-322.

38. Willard W. Cutler, Jr., *Estimation of Underground Oil Reserves by Oil-Well Production Curves* (Washington, D.C.: Government Printing Office, 1924), 15. Another

it cited, published in 1919, was more than 200 pages in length and dealt with techniques for mathematical modeling of oil production and decline curves and their use to estimate future production rates.[39] By this time, researchers were also creating "average" or "composite" curves that tracked production and decline rates of multiple properties or fields, and they were beginning to analyze how to develop such curves at still higher levels of aggregation. A member of the U.S. Geological Survey published an article in 1925 in which he tested mathematical curve-fitting techniques using aggregate oil production data for West Virginia from 1875 to 1923. He noted that national oil production and decline curves could be similarly modeled and analyzed. Use of decline curve analysis decreased in the depression years because the introduction of prorationing restricted oil field production to lower and more even flows, altering decline curve profiles. Yet the topic attracted new attention with the surging demand for oil in WWII.[40]

The post-WWII era brought a new phase in the development of oil depletion theory, initiated by American geophysicist Marion King Hubbert in a series of papers he published between 1949 and 1982. Whereas the approach before WWII was bottom-up, based mainly on tracking production of individual properties or fields (albeit with some attention given to developing production curves using aggregate data), Hubbert took a top-down approach. He thought about how oil production in a large region (the United States or the world) would play out from beginning to end. The production "life cycle" would start from zero and, given oil's finite, non-renewable character, would return to zero at some unknown time in the future, when production ceased (e.g., through unprofitability or inaccessibility). Between the beginning and end points, the rate of oil extraction would first grow and then would eventually decline again. Somewhere in between, the rate of production would have to reach a maximum. Hubbert diagrammed this life cycle for aggregate oil production as a symmetric, bell-shaped curve with exponential growth

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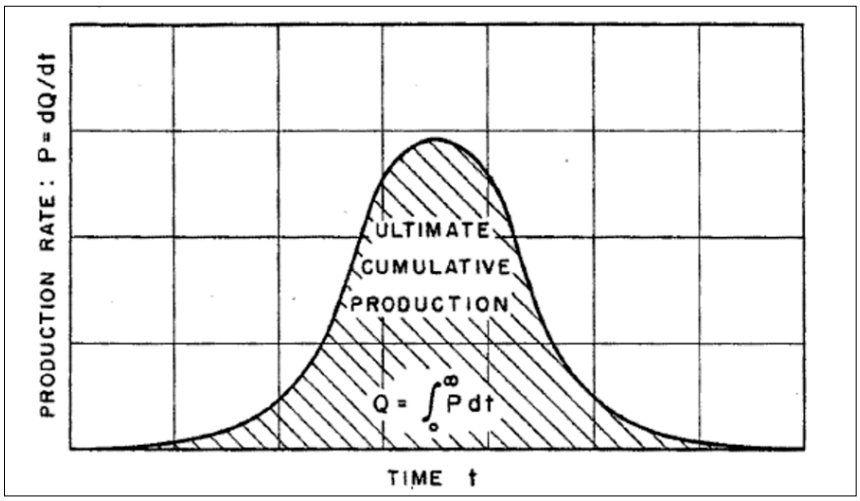
overview was done by Ralph Arnold, J.L. Darnell, et al, *Manual for the Oil and Gas Industry Under the Revenue Act of 1918* (New York: John Wiley & Sons, 1920), 80-176.

39. Carl H. Beal, *The Decline and Ultimate Production of Oil Wells, with Notes on the Valuation of Oil Properties* (Washington, D.C.: Government Printing Office, 1919).

40. C.E. Van Orstrand, "On the Empirical Representation of Certain Production Curves," *Journal of the Washington Academy of Sciences* 15, 2 (January 19, 1925): 19-33; J. J. Arps, "Analysis of Decline Curves," *Transactions of the American Institute of Mining, Metallurgical and Petroleum Engineers* 160, 1 (1945): 228-247. Decline curve analysis continued to be used in the oil industry. An article from 1980, written by an engineer with the Phillips Petroleum Co., characterized decline curve analysis as "one of the oldest and most often used tools of the petroleum engineer." See M. J. Fetkovich, "Decline Curve Analysis Using Type Curves," *Journal of Petroleum Technology* 32, 6 (1980): 1065-1077.

and decline phases.[41] The *x*-axis of the curve represented the time dimension, while the *y*-axis represented the rate of extraction of the resource at each time, *t* (Figure 1). He proposed a single, symmetric curve because he reasoned that the diversity of curves from individual fields and smaller regions would tend to cancel each other out when consolidated. The assumption about exponential growth and decline was based on empirical evidence and the "technology of production."[42]

Figure 1. M. King Hubbert's Idealized Oil Production Lifecycle Curve. Q refers to the total amount of oil recovered over the full life cycle and is equal to the area under the curve.



Source: Hubbert M. King (1956), Pub. No. 95, Shell Devel. Co. Exploration and Production Research Division (Figure 4 - Mathematical relations involved in the complete cycle of production of any exhaustible resource).

In contrast to the decline curves that had been the focus of earlier research, Hubbert's top-down approach put emphasis on the growth phase of oil production (as new fields were progressively discovered and exploited). It also emphasized the point at which the rate of national or

41. M. King Hubbert, "Nuclear Energy and the Fossil Fuels," Presented before the Spring Meeting of the Southern District Division of Production, American Petroleum Institute, San Antonio, Texas, 8 March 1956. Publication No. 95 (Houston: Shell Development Company, Exploration and Production Research Division), 9-11. Available at: http://www.hubbertpeak.com/hubbert/1956/1956.pdf, accessed 3 April 2014.
42. Hubbert, "Nuclear Energy and the Fossil Fuels," 9-11; M. King Hubbert, "Energy Resources," in National Academy of Sciences-National Research Council, Committee on Resources and Man, *Resources and Man: A Study and Recommendations* (San Francisco: W.H. Freeman and Co., 1969), 167-168.

global oil production would peak. The concept of an oil production peak was not new, but it had not previously been depicted as a fundamental turning point in the energy history of nations and the world.[43] Hubbert put the peak into the limelight and gave it precedence over the end stage of the oil production life cycle. In practice this shift in emphasis implied that society needed to prepare for inevitable changes associated with declining rates of oil production much sooner than had previously been assumed—not toward the end of the life cycle, but in the middle, ideally while production was still increasing, since changes would begin to occur once the halfway point was reached. Finally, Hubbert's approach transformed oil depletion theory from a practical tool to assist oil production, investment, and taxation into an approach that invited deeper reflection upon the role and future of fossil fuels in human society.

Hubbert's curve was a simplified, idealized mathematical model.[44] Such models have heuristic value. They help to study how systems will behave under various conditions and to estimate future states of the system being modeled. Yet they also have limitations, including the simplifications required to make them manageable, and dependence on data inputs that may not have great accuracy, reliability, or provide adequate coverage.[45] Despite such limitations, contemporary sciences have widely embraced mathematical modeling, and decisions in many realms, from determining insurance premiums to forecasting commodity prices, economic growth, weather, and climate change, involve probabilities, estimates, and

43. Nevertheless, fears had been expressed in the U.S. after WWI that national oil production levels might soon begin to decline. See White, David. "The Petroleum Resources of the World," *The Annals of the American Academy of Political and Social Science* 89, 1 (1920): 111-134.

44. Hubbert explained ways in which the actual oil production curve for the U.S. might differ from the model. He observed that the production curve for the U.S. might not prove to be symmetrical and that the peak might not occur exactly when half of the resource had been extracted, and he noted factors that could alter the curve's actual profile. See Hubbert, Nuclear Energy and the Fossil Fuels," 24; M. King Hubbert, *Energy Resources: A Report to the Committee on Natural Resources of the National Academy of Sciences-National Research Council* (Washington, DC: National Academy of Sciences-National Research Council, 1962), 63-64; Hubbert, "Energy Resources," (1969), 175-176; M. King Hubbert, "Techniques of Prediction as Applied to the Production of Oil and Gas," in *Oil and Gas Supply Modeling,* ed. S.I. Gass, Pub. 631 (Gaithersburg, Maryland: National Institute of Standards and Technology, 1982), 33-34, 46, 138-141.

45. Naomi Oreskes, Kristin Shrader-Frechette, and Kenneth Belitz, "Verification, Validation, and Confirmation of Numerical Models in the Earth Sciences," *Science* 263, 5147 (1994): 641-646; Naomi Oreskes, "The Role of Quantitative Models in Science," in *Models in Ecosystem Science*, eds. Charles Draper William Canham, Jonathan Cole and William K. Lauenroth (Princeton: Princeton University Press, 2003), 13-31. The limitations of energy supply modeling are emphasized in Vaclav Smil, "Perils of Long-Range Energy Forecasting: Reflections on Looking Far Ahead," *Technological Forecasting and Social Change* 65, 3 (2000): 251-264.

forecasts based on models. The expanding use of mathematical modeling broadly reflects the shift toward a "risk society."[46]

Meteorology is an example of model-dependent science that people rely on almost daily. Weather forecasting models cannot give perfect predictions, even in principle. Forecasts have an unavoidable margin of error, which becomes progressively larger for longer-term forecasts, so there will continue to be incorrect forecasts in the future. Yet these limitations do not render the models meaningless or leave them without value. Weather models and meteorology are not rejected because of incorrect forecasts. Instead, meteorologists keep working to update and enhance the models and improve the data on which they depend. The material and economic advantages of doing so outweigh the disadvantages of continued errors and uncertainties.[47]

Modeling oil production life cycles shares some important characteristics with modeling weather systems. In both cases, the models depend on inadequate and imperfect data. (Even data on past oil production is imperfect.)[48] And in both cases, they involve variables that cannot always be reliably or accurately modeled, estimated, or forecast. In the case of oil production, these variables range from the way different geological formations affect production flows to the way events, regulations, or economic forces affect production decisions, to the influence of changing technologies that improve discovery, broaden the range of exploitable oil resources (e.g. deep sea oil), or enhance oil recovery. Yet, as with weather forecasting, the absence of perfect knowledge does not render the models meaningless or leave them without value, and researchers try to find ways to alleviate or work around such problems.

A very important matter for oil depletion theory involves the amount of recoverable oil initially in the ground—the size of the "ultimately recoverable resource" (URR). This is an unknown quantity that has to be estimated. Its value affects a production curve's profile, and thus the

46. Ulrich Beck, *Risk Society: Towards a New Modernity* (London: Sage, 1992). See also Phaedra Daipha, "Weathering Risk: Uncertainty, Weather Forecasting, and Expertise," *Sociology Compass* 6, 1 (2012): 15-25.

47. Daipha, "Weathering Risk"; Paul N. Edwards, *A Vast Machine: Computer Models, Climate Data, and the Politics of Global Warming* (Cambridge, MA: MIT Press, 2010). See also his articles: "Meteorology as Infrastructural Globalism," *Osiris* 21, 1 (2006): 229-250; "Predicting the Weather: An Information Commons for Europe and the World," in *Cosmopolitan Commons: Sharing Resources and Risks across Borders*, eds. Nil Disco and Eda Kranakis (Cambridge, MA: MIT Press, 2013), 153-184; and "Global climate Science, Uncertainty and Politics: Data-Laden Models, Model-Filtered Data," *Science as Culture* 8, 4 (1999): 437-472.

48. The data problems associated with peak oil modeling are discussed in Kjell Aleklett and Colin J. Campbell, "The Peak and Decline of World Oil and Gas Production," *Minerals and Energy-Raw Materials Report* 18, 1 (2003): 5-20.

expected time when a production peak would occur. Hubbert addressed this problem in four ways. First, he sought a consensus of expert opinion about the most probable value of the URR for the U.S. lower 48 states and for the world.[49] Second, he developed two alternate methods to estimate the URR for the U.S. (lower 48 states), which depended only on past production data and past data for proved reserves and exploratory drilling.[50] Finally, Hubbert always ran his life-cycle models for U.S. oil production with two different values for the URR, in order to see how the system's behavior varied with the change in URR. This last technique brought surprising results because it indicated that a sizeable increase (33%) in the presumed value of the URR for the U.S. would delay the estimated peak date by only around five years, while a 100% increase would delay the date by only around 12 years.[51]

Peak Oil Theory Since Hubbert

Although Hubbert's conclusions drew challenges, directed particularly at the URR values he used,[52] geologists embraced Hubbert's modeling methods. The latter have been adapted and applied on an ever-increasing scale that vastly exceeds the scale of professional opposition to his ideas.[53] A search in "Google Scholar" of articles that include the terms "Hubbert," "curve," "production," and "peak," together with at least one of the terms "oil," "petroleum," "gas," or "energy," produces about 19,000 hits. Although some of these are false hits, there is a clear pattern of exponential growth, with the majority of hits occurring after the year 2000. Visual inspection of the first 300 hits in the post-2000 period reveals that a significant majority of them are contributions in what we may call the "Hubbert tradition." They have appeared in journals

49. Hubbert, "Nuclear Energy and the Fossil Fuels," 13-20.
50. Hubbert, *Energy Resources: A Report* (1962), 52-63; M. King Hubbert, "Degree of Advancement of Petroleum Exploration in United States," *American Association of Petroleum Geologists Bulletin* 51, 11 (1967): 2207-2227.
51. Hubbert, "Nuclear Energy and the Fossil Fuels," 23-25; Hubbert, *Energy Resources: A Report* (1962), 72-73; Hubbert, "Techniques of Prediction as Applied to the Production of Oil and Gas," (1982), 41-43.
52. The URR debate is analyzed by Bowden, "The Social Construction of Validity in Estimates of US Crude Oil Reserves," and is discussed by Priest, "Hubbert's Peak: The Great Debate over the End of Oil." See also the transcript of a series of oral history interviews of M. King Hubbert conducted by Ronald Doel in January and February of 1989, deposited at the library and archives of the American Institute of Physics. The interviews are available at: http://www.aip.org/history/ohilist/5031_4.html, accessed 17 June 2014.
53. Although Hubbert's conclusions raised opposition from the side of industry and government, the challenge was not directed against his mathematical model in general, but rather against his assumed values for the URR (even though these values were the consensus of leading geologists).

specializing in geology, energy, the oil and gas sector, applied mathematics, and resources and environment. Articles have also appeared in general scientific journals like *Science,*[54] *Nature*,[55] and *Scientific American*.[56] A growing number of books that diffuse and extend oil depletion theory have been published as well.[57]

In Canada, leading geologists and geophysicists championed and applied Hubbert's ideas. Among them was John Tuzo Wilson, a pioneer of plate tectonics. The first mention of Hubbert's curve in the *Globe and Mail* appeared in an opinion piece written by Wilson, "Why Canada Should Guard Arctic Oil," published in 1972, although he did not utilize the term "peak oil."[58] Two years earlier, another leading Canadian geologist, Robert E. Folinsbee, published the first Hubbert curve analysis of Canadian oil production.[59] Folinsbee also developed one of the earliest applications of "Zipf's Law" to the study of oil depletion and estimation of future oil discoveries. His paper on this subject, written as a presidential address to the Geological Society of America, continues to be cited today.[60] In 1976, geologist Raymond A. Price published an article

54. An example is Charles A.S. Hall and Cutler J. Cleveland, "Petroleum Drilling and Production in the United States: Yield Per Effort and Net Energy Analysis," *Science* 211 (6 February 1981), 576-579.

55. E.g. James Murray and David King, "Climate Policy: Oil's Tipping Point Has Passed," *Nature* 481, 7382 (2012): 433-435.

56. Notably Campbell and Laherrère, "The End of Cheap Oil."

57. Some noteworthy examples include Campbell, *The Coming Oil Crisis*; Colin J. Campbell, *The Golden Century of Oil, 1950-2050: The Depletion of a Resource* (Dordrecht; Boston: Kluwer Academic Publishers, 1991); Colin J. Campbell, ed., *The Essence of Oil & Gas Depletion: Collected Papers and Excerpts* (Brentwood, Essex, England: Multi Science Publishing Co., 2003); Deffeyes, *Hubbert's Peak*; Kenneth S. Deffeyes, *Beyond Oil: The View from Hubbert's Peak* (New York: Hill and Wang, 2005); Goodstein, *Out of Gas*; Aleklett et al*., Peeking at Peak Oil*; Hall and Klitgaard, *Energy and the Wealth of Nations*.

58. J. Tuzo Wilson, "Why Canada Should Guard Arctic Oil" *Globe and Mail*, 17 October 1972, 7.

59. R.E. Folinsbee, "Nuclear Energy and the Fossil Fuels," *Transactions of the Royal Society of Canada. 4th series*, 8 (1970): 335-359. See also R.E. Folinsbee and A.P. Leech, "Energy — Challenge Of Man's Future: Fossil Fuel — A Dream That Is Dying," *Geoscience Canada* 1, 1 (1974): 19-23. Folinsbee served as President of the Geological Society of America and of the Royal Society of Canada.

60. R.E. Folinsbee, "World's View—from Alph to Zipf; Address as Retiring President of the Geological Society of America, Denver, Colorado, November 1976," *Geological Society of America Bulletin* 88, 7 (July 1977): 897-907. Zipf's law offers a probabilistic tool to estimate the size of ultimately recoverable oil resources, based on the empirical fact that average sizes of oil fields discovered diminish over time. According to E.C. Dahlberg, Zipf's law, as applied to oil fields, "postulates most simply that the largest will be twice the size of the second, three times as great as the third, and one hundred times bigger than the hundredth, etc. This implies that deposits become infinitesimally small as their number goes to infinity." Quoted from E.C. Dahlberg, "Pros and Cons of Zipf's Law as a Resource

with Hubbert and several other geologists that included a discussion of oil depletion and of Hubbert's projected curve for world oil production.[61] At the time, Price was Chair of the Department of Geological Sciences at Queen's University and he subsequently became Director-General of the Canadian Geological Survey, and also President of the Geological Society of America.[62] Today we still find Canadian geologists making prominent contributions to peak oil research, an example being J. David Hughes.[63]

In order to gain a sense of the expanding scope of peak oil theory since Hubbert, it is helpful to characterize several of the more important trends. First, Hubbert modeling has been widely applied to chart regional, national, and global production curves. Not only have world oil production curves been developed and continually updated, but every oil-producing country has also been tracked to determine its date of peak production, along with areas like the North Sea.[64] Much has been learned from these exercises, carried out over four decades. They show, for example, that more than 60 nations have passed the peak of crude oil production since Hubbert's breakthrough 1956 paper,[65] roughly a third since 2000, and they show that conventional crude oil production plateaued worldwide around 2005.[66]

Appraisal Tool: Abstract," *Canadian Society of Petroleum Geologists Memoir* 6 (1980): 987.

61. W. von Engelhardt et al, "Earth Resources, Time, and Man—A Geoscience Perspective," *Environmental Geology* 1, 4 (1976): 193-206.

62. See the Wikipedia entry on Raymond J. Price.

63. J. David Hughes is a geoscientist who worked for the Geological Survey of Canada for over three decades. See J. David. Hughes, "Energy: A Reality Check on the Shale Revolution," *Nature* 494, 7437 (2013): 307-308. See also his chapter "The Energy Issue: A More Urgent Problem than Climate Change?" in *Carbon Shift: How Peak Oil and the Climate Crisis Will Change Canada (and Our Lives)*, Thomas Homer-Dixon, ed. (Toronto: Random House Canada, 2009), 59-96. Hughes also authored two longer and widely cited studies, sponsored by the Post Carbon Institute in Santa Rosa, California: *Drill, Baby, Drill: Can Unconventional Fuels Usher in a New Era of Energy Abundance?* (Santa Rosa, California: Post Carbon Institute, 2013); and *Drilling Deeper: A Reality Check on U.S. Government Forecasts for a Lasting Tight Oil & Shale Gas Boom* (2014). Both studies can be accessed at the website of the Post Carbon Institute.

64. See, e.g. Colin John Campbell and Alexander Wöstmann, *Campbell's Atlas of Oil and Gas Depletion, 2nd ed.* (New York and Dordrecht: Springer, 2013); Lianyong Feng, Junchen Li, and Xiongqi Pang, "China's Oil Reserve Forecast and Analysis Based on Peak Oil Models," *Energy Policy* 36, 11 (2008): 4149-4153.

65. Steve Sorrell et al, "Shaping the Global Oil Peak: a Review of the Evidence on Field Sizes, Reserve Growth, Decline Rates and Depletion Rates," *Energy* 37, 1 (2012): 721. Additional data are provided in the country overviews of oil production of the EIA website.

66. Murray and King, "Oil's Tipping Point Has Passed"; Richard G. Miller and Steven R. Sorrell, "The Future of Oil Supply," *Philosophical Transactions of the Royal Society A* 372, 2006 (2014): 3. Conventional crude oil in these statistics does not include natural gas liquids or unconventional oil sources.

Second, there has been a proliferation of curve-fitting models.[67] One group consists of hybrid models that combine physical and econometric approaches in order to overcome the deficiencies of each when used alone. In the words of a leading proponent of this approach, "the method incorporates two aspects of oil supply...the physical limits on supply...and the price elasticity of supply."[68] These dual aspects are grafted together, for example by plugging economic variables into equations for a Hubbert curve.

Another type of curve-fitting approach—the use of what has been termed *creaming curves*—emerged in the oil industry and has also become an important tool for peak oil theorists. Two Shell Oil Company engineers outlined the technique in a 1981 paper.[69] It depended on the well-known phenomenon that the biggest oil fields in a region ("cream of the crop") were normally discovered first, and over time, the size of the fields discovered became progressively smaller. In effect, the volume of oil discovered per exploratory well tended to decline over time. Creaming curves chart cumulative number of exploration wells (x-axis) against cumulative volume of oil discovered (y-axis), with each point on the curve representing these values at a given time (see Figure 2).

Extrapolating the creaming curve for a region gives a projected value for its URR, based strictly on past discovery data. A creaming curve can provide an indication of whether a given region is largely tapped out or still offers discovery prospects. Several variants on the creaming curve method have also been devised, and together they are referred to as discovery process models.[70] They continue to be widely used by oil companies to help make decisions about drilling prospects and to estimate

67. For an overview, see Adam R. Brandt, "Review of Mathematical Models of Future Oil Supply: Historical Overview and Synthesizing Critique," *Energy* 35, 9 (2010): 3958-3974; Steve Sorrell and Jamie Speirs, "Hubbert's Legacy: a Review of Curve-Fitting Methods to Estimate Ultimately Recoverable Resources," *Natural Resources Research* 19, 3 (2010): 209-230; Steve Sorrell and Jamie Speirs, "Using Growth Curves to Forecast Regional Resource Recovery: Approaches, Analytics and Consistency Tests," *Philosophical Transactions of the Royal Society A: Mathematical, Physical and Engineering Sciences* 372, 2006 (2014): 20120317.

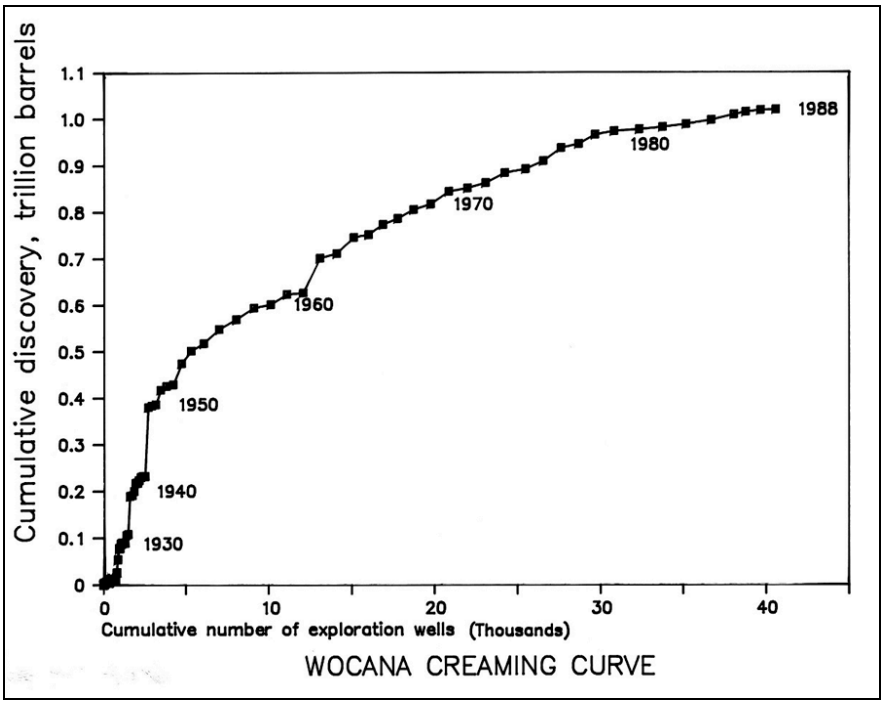
68. Robert K. Kaufmann, "Oil Production in the Lower 48 States: Reconciling Curve Fitting and Econometric Models," *Resources and Energy* 13, 1 (1991): 122.

69. J. Meisner and F. Demirmen, "The Creaming Method: a Bayesian Procedure to Forecast Future Oil and Gas Discoveries in Mature Exploration Provinces," *Journal of the Royal Statistical Society. Series A (General)* 144, 1 (1981): 1-31.

70. For overviews of discovery process models, see Lawrence J. Drew and John H. Schuenemeyer, "The Evolution and Use of Discovery Process Models at the US Geological Survey," *AAPG Bulletin* 77, 3 (1993): 467-478; Sorrell and Speirs, "Hubbert's Legacy: a Review of Curve-Fitting Methods;" Sorrell and Speirs, "Using Growth Curves to Forecast Regional Resource Recovery."

drilling costs in mature oil basins.[71] They have also been used by government agencies such as the Norwegian Petroleum Directorate,[72] the Australian Bureau of Mineral Resources, and the U.S. Geological Survey, to help estimate recoverable reserves.[73]

Figure 2. A 1989 creaming curve. WOCANA refers to "World Outside Communist Areas and North America".



Source: Reproduced with permission from Dr. Marinus Herman Nederlof. The illustration is taken from his website at: http://www.mhnederlof.nl/creaming.html, accessed 17 April 2015.

71. K.J. Sklaar, A.M. Spencer, P. Alexander-Marrack, and G. Støle, "Suggestions for an Improved Exploration Process—Lessons from the Project Evaluation of Norwegian Wildcat Wells," in *Improving the Exploration Process by Learning from the Past*, eds. K. Ofstad, E.-J. Kittilsen and P. Alexander-Marrack (Amsterdam: Elsevier, 2000), 61-62. See also Jon Gluyas and Richard Swarbrick, *Petroleum Geoscience* (New York: John Wiley and Sons, 2013).
72. See: http://www.npd.no/en/Publications/Resource-Reports/2013/Chapter-5/, accessed 8 February 2015.
73. Gordon M. Kaufman, "Statistical Issues in the Assessment of Undiscovered Oil and Gas Resources," *The Energy Journal* 14, 1 (1993): 193, 195.

Third, computerization has fostered expansion of *bottom-up* modeling methods. These methods are widely used "by energy companies, energy consultancy firms, banks and public institutions to guide investments and policymaking."[74] In these contexts, they are often used for analysis of production and depletion cycles for individual fields, yet computerization makes it easier to aggregate field data in order to model regional and global oil production life cycles. Global aggregation poses the challenge of accessing reliable, field-by-field data for the entire world, however. Currently the oil-industry consulting firm IHS CERA controls the best database, and it costs around a million dollars to use their complete set of field-by-field data. British Petroleum, the world's second largest oil company, used this database between 1991 and 2008 to carry out a long-term, global oil supply forecasting study. The analysis was done by geologist Richard G. Miller, who, following his retirement from BP, has become a leading contributor to peak oil analysis.[75]

One other fundamental approach in the current toolbox of peak oil theory is "net energy analysis." Rooted in the study of ecological energetics (energy flows in ecological systems)[76] and in what has come to be known as industrial ecology (including techniques of input-output analysis),[77] net energy analysis took form in the 1970s and 1980s.[78] It aims to analyze the energy costs required to produce energy from specific sources. It also aims to understand, in general, how such costs shift over time. In the early 1980s, the term EROI (also referred to as EROEI), or "energy returned on energy invested," was introduced to describe and highlight a crucial parameter, namely "the ratio of energy delivered to energy used in the delivery process."[79]

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74. Kristofer Jakobsson et al, "Bottom-Up Modeling of Oil Production: A Review of Approaches," *Energy Policy* 64 (2014): 113.

75. Steve Andrews, "The Future of Oil Supply: An Interview with Dr. Richard G. Miller," 17 February 2014, available at: http://peak-oil.org/2014/02/the-future-of-oil-supply-an-interview-with-dr-richard-g-miller/, accessed 13 February 2015.

76. For an historical perspective, see Inge Røpke, "The Early History of Modern Ecological Economics," *Ecological Economics* 50 (2004): 293-314.

77. P. F. Chapman, G. Leach, and M. Slesser, "The Energy Cost of Fuels," *Energy Policy* 2, 3 (1974): 231-243.

78. Cutler J. Cleveland, "Biophysical Economics: Historical Perspective and Current Research Trends," *Ecological Modelling* 38, 1 (1987): 47-73; and Cutler J. Cleveland, "Biophysical Economics: From Physiocracy to Ecological Economics and Industrial Ecology," in *Bioeconomics and Sustainability: Essays in Honor of Nicholas Gerogescu-Roegen*, eds. Kozo Mayumi and John M. Gowdy (Cheltenham, England: Edward Elgar, 1999), 125-154.

79. Cutler J. Cleveland, "Energy Quality and Energy Surplus in the Extraction of Fossil Fuels in the US," *Ecological Economics* 6, 2 (1992), 140; Cutler J. Cleveland, Robert Costanza, Charles A. S. Hall, and Robert Kaufmann, "Energy and the U.S. Economy: A Biophysical Perspective," *Science*, n.s. 225, 4665 (August. 31, 1984): 890-897.

For example, in the U.S. in 1930, the energy input required to produce 100 barrels of oil was equivalent to one barrel of oil, so the EROI was 100:1. Studies have shown that EROI values for the fossil fuels tend to decrease over time (less energy is delivered for a given energy input), essentially because easily accessible and exploitable resources are tapped first. As production shifts to less accessible oil resources, and as exploitation of large fields gives way to exploitation of a larger number of smaller fields, the EROI ratio declines. Today the EROI for oil production in the U.S. is estimated to be 11:1. And for alternate resources like the Athabasca tar sands (which require processing solid bitumen to make synthetic oil), the EROI is lower still, estimated to be less than 5:1.[80] Beyond attempts to develop appropriate techniques for EROI analysis, and reliable values for specific cases, studies in this domain have also broached larger questions of the relationship of EROI to oil prices, economic growth/decline, and sustainability.[81]

In 2014 a leading international scientific journal, the *Philosophical Transactions of the Royal Society*, devoted an entire issue to peak oil. Billed as bringing together "the best scientific evidence" on the subject,[82] the assembled articles explained the basics of oil depletion and peak oil analysis,[83] reviewed the development of curve-fitting models,[84] discussed research on decline rates and oil reservoir depletion rates,[85] and surveyed contributions to net energy analysis.[86] The theme issue also included an article by Peter M. Jackson and Leta K. Smith,[87] both employed with IHS CERA, the energy consulting firm known as a leading opponent of peak oil thinking.[88] Several years earlier, Peter M. Jackson had authored a

80. David J. Murphy and Charles A. S. Hall, "Year in Review—EROI or Energy Return on (Energy) Invested," *Annals of the New York Academy of Sciences* 1185 (2010): 109.

81. See the review article by David J. Murphy, "The Implications of the Declining Energy Return on Investment of Oil Production," *Philosophical Transactions of the Royal Society A* 372, 2006 (2014): 20130126.

82. See http://rsta.royalsocietypublishing.org/site/2014/2006.xhtml, accessed 29 September 2014.

83. Miller and Sorrell, "The Future of Oil Supply," 1-27.

84. Sorrell and Speirs, "Using Growth Curves to Forecast Regional Resource Recovery."

85. Mikael Höök et al., "Decline and Depletion Rates of Oil Production: a Comprehensive Investigation," *Philosophical Transactions of the Royal Society A* 372, 2006 (2014): 20120448.

86. Murphy, "The Implications of the Declining Energy Return on Investment of Oil Production."

87. Peter M. Jackson and Leta K. Smith, "Exploring the Undulating Plateau: the Future of Global Oil Supply," *Philosophical Transactions of the Royal Society A* 372, 2006 (2014): 20120491.

88. Daniel Yergin founded CERA (Cambridge Energy Research Associates) as an energy consulting firm in 1983. In 2004 it was taken over by IHS, an information and data products firm, and it currently uses the name IHS CERA.

CERA report criticizing peak oil theory,[89] and CERA Senior Consultant and Director Robert Esser was reported by *Bloomberg Businessweek* to have stated, "Peak oil theory is garbage."[90]

The position of IHS CERA as supposedly a leading opponent of peak oil theory, and the position of the *Philosophical Transactions of the Royal Society* as one of the world's oldest, most respected, refereed scientific journals, make this article of particular interest. What is the scientific approach of opponents to peak oil theory, and how does the article position itself relative to the vast research terrain that has come to constitute peak oil theory? What we find is that the article by Jackson and Smith is written in the Hubbertian tradition. Acknowledging that oil is a finite, non-renewable resource, the IHS CERA analysts characterized the notion that oil supply might increase forever as a "utopian view" that was "not supported by the fact that the global hydrocarbon endowment, whatever that turns out to be, is finite and sufficient only to support limited and slow short-term capacity growth from current levels."[91] Jackson and Smith reiterated the empirical foundation of oil production curve analysis, explaining that:

> oilfield production typically builds rapidly to a maximum rate, which may be maintained briefly or for some years (the 'plateau'), and then enters a long period of decline until the field is depleted, which is the point at which oil can no longer be recovered economically.[92]

They explained that what differentiated their model from other "peak models" was "the timing of the onset of a dramatic slowdown in the rate of growth of supply" and "the existence or otherwise of a production plateau."[93]

Jackson and Smith proposed a later onset of decline and a slower decline than that projected in 2009 by a leading peak oil analyst, Colin J. Campbell.[94] They proposed an "undulating plateau" that would extend for a couple of decades. Jackson and Smith's projections supposed a larger

89. Peter Jackson, *Why the Peak Oil Theory Falls Down: Myths, Legends, and the Future of Oil Resources*, *CERA Decision Brief* (Cambridge, MA, Cambridge Energy Research Associates, 2006).

90. Mark Morrison, "Plenty of Oil—Just Drill Deeper," *Bloomberg Businessweek*, 6 September 2006, available at: http://www.bloomberg.com/bw/stories/2006-09-06/plenty-of-oil-just-drill-deeperbusinessweek-business-news-stock-market-and-financial-advice, accessed 16 April 2015.

91. Jackson and Smith, "Exploring the undulating plateau," 13.

92. Ibid., 5.

93. Ibid., 14.

94. Campbell, a geophysicist with a PhD from Oxford (1957), worked thirty years as an oil geologist and consultant for major oil companies, including Texaco, BP, Amoco, Shell, Total, Esso, and Fina. He made the first discovery of oil off the coast of Norway, and became Executive Vice President of Fina (Norway). He was a founding member of the Association for the Study of Peak Oil and Gas (ASPO).

URR than Campbell's, a larger capacity for growth of both conventional and unconventional sources, and slower decline rates. Their model also included biofuels and coal-to-gas liquids, which Campbell's did not. They also classified tight oil and heavy oil as conventional oil, which Campbell did not.[95] The CERA researchers qualified their model, however, by citing many factors that could affect their projected global production curve, and they admitted, "a short-term peak followed by a rapid production decline is not totally out of the question."[96] Ultimately, their analysis offered no grounds for a rejection of peak oil theory, and they even put forward their own post-peak decline scenario of unrelenting supply shortfalls:

> The scale of effort needed to maintain supply growth in the long term will ultimately not be achievable as most of the world's largest fields reach late maturity in production terms and discovery sizes continue to dwindle. Although great efforts will be made to exploit high-cost oil from unconventional sources and remote, harsh environments and Herculean efforts will be needed to exploit mature assets, the supply–demand equation will eventually fail to balance as gradual decline sets in.[97]

The IHS CERA researchers' analysis—although cited by Daniel Yergin as an *alternative* to peak oil thinking—was actually a peak-oil forecast, modified to include a wider resource base and more optimistic projections of URR and future discoveries. In the bigger scheme of things, IHS CERA's projections changed the overall picture of oil depletion very little. Considered in relation to the 200,000-year timespan of human existence, IHS CERA's shifting of the projected time frame for the onset of global oil production decline by a couple of decades was almost inconsequential.

Peak Oil Theory in the Globe and Mail

The question of how the mass media portray scientific knowledge involves a fundamental, perhaps unresolvable tension: scientific knowledge has become increasingly complex and recondite whereas the mass media have embraced simplification and a culture of quick generalization (the proverbial "sound-byte"). Newspapers, according to the Canadian Association of Journalists, aim at a broad audience and

95. The rationale of Jackson and Smith for including tight oil as conventional oil is that it is "geochemically conventional." However, it is worth noting that the International Energy Agency (IEA) and the Alberta Energy Regulator both classify tight oil as unconventional because its method of production differs from that of conventional oil and is more difficult. See:
http://www.aer.ca/about-aer/spotlight-on/unconventional-regulatory-framework/what-is-unconventional-oil-and-gas, accessed 10 February 2015.
96. Jackson and Smith, "Exploring the undulating plateau," 14.
97. Ibid., 16.

favor "plain language and storytelling techniques."[98] Most articles do not exceed half a page. None of these characteristics mesh easily with the goal of explaining intricate, multilayered scientific arguments. So can we expect even a premier national and business newspaper like the *Globe and Mail* to say anything meaningful about an esoteric body of theoretical and empirical knowledge like peak oil?

If we consider this question in relation to the *Globe and Mail's* coverage of meteorology (for weather forecasting) and climate change science, the answer is yes. Meteorology and climate change science developed in the same era as peak oil theory, all three are oriented toward prediction, and all rely on mathematical models incorporating many uncertainties and imperfect data. The *Globe and Mail* has covered both meteorology and climate change science extensively enough to make a good comparison with its coverage of peak oil.[99] Meteorology is a science that average people depend on every day, while climate change science, like peak oil theory, has controversial and pessimistic implications. It can also be argued that meteorology and climate change science are theoretically more complex than peak oil analysis and involve more diverse forms and sources of empirical data, so in principle, it should be easier to explain peak oil theory.

The *Globe and Mail's* coverage of meteorology and climate change displays several characteristics that are relevant for evaluating its coverage of peak oil. First, a number of articles reported on theory development. One, for example, recounted how meteorologist Edward Lorenz developed chaos theory from his modeling efforts, devoting many paragraphs to explain that theory's important ideas.[100] Another discussed the contents of a paper published in the *Philosophical Transactions of the Royal Society* (the same journal that devoted an issue to peak oil science). The *Globe and Mail* article explained that the scientific paper's authors had modeled the relationship between global warming and melting ice caps using some new data and a methodology that encompassed positive feedback loops, which were not included in the models used by the UN's International Panel on Climate Change (IPCC). As a result, whereas the IPCC projected sea level increases of 18 to 25 centimeters in the next

98. Ethics Advisory Committee of The Canadian Association of Journalists, "What is Journalism?" 15 June 2012, 4, http://www.caj.ca/wp-content/uploads/2012/07/CAJ-WhatisJournalism.doc-1.pdf, accessed 16 April 2015. For an overview of science coverage in the Canadian press, see Edna F. Einsiedel, "Framing Science and Technology in the Canadian Press," *Public Understanding of Science* 1, 1 (1992): 89-101.

99. I reviewed around 50 articles from the *Globe and Mail* that discussed meteorology or climate change science over the same period of coverage as the articles on peak oil theory, i.e. from 2000 to 2014.

100. Kenneth Chang, "Edward Lorenz, 90; Scientist: Father of Chaos Theory Described the 'Butterfly Effect'," *Globe and Mail*, 18 April 2008, S9.

century, the new model forecast that sea levels would rise "several metres by 2100—or maybe even as much as 25 metres."[101]

Second, *Globe and Mail* articles on meteorology and climate change science called attention to the complexities and limitations of the models, the fact that they had to make inferences from imperfect data, and that the models and data needed to be continually updated in order to improve forecasting accuracy. The models were nevertheless portrayed as legitimately scientific and as components of expanding, authoritative bodies of knowledge.[102] No article suggested that the models should be rejected because of imperfect forecasts or that efforts to make forecasts should be abandoned because the models did not perfectly replicate reality. In the case of climate change science, for example, several articles discussed the difficulties of analyzing polar ice and estimating how its melting would affect sea levels. One cited an eminent Canadian scientist who emphasized the need for the IPCC to improve the models:

> The mathematical models, which we have developed to describe the evolution of ice sheets, do not include certain processes that control how quickly an ice sheet could respond to climate warming . . . . You need a model that incorporates all physical processes – and no such model exists.[103]

Third, the *Globe and Mail* articles on meteorology and climate change science reported on the sources and limitations of empirical data needed to develop and evaluate the models. Articles discussed data from historical records, radar, satellites, and submarines, and from terrestrial sources ranging from lakes to sea vents spewing carbon dioxide.[104] A half-page

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101. Zoe Cormier, "The New Climate: a Controversial Study Suggests Rapid Polar Meltdown and Rising Sea Levels," The *Globe and Mail*, 25 August 2007, F9.

102. Alanna Mitchell, "The Northwest Passage Thawed," *Globe and Mail*, 5 February 2000, A11; Bob Weber, "Canadian Scientists Discover New Clues to Rapid Arctic Ice Melt," *Globe and Mail*, 28 June 2011, Factiva (GMBN000020110628e76s001md); Ivan Semeniuk, "Science Team Identifies Tipping Point in Climate Change: 2047," *Globe and Mail*, 9 October 2013, Factiva (GMBN000020131009e9a9003bi); Ivan Semeniuk, "The Unfrozen North, Circa 2067," *Globe and Mail*, 12 April 2014, F5; Ivan Semeniuk, "A Search for Clues Behind the Smoke," *Globe and Mail*, 15 July 2014, A6; "IBM Computer to Tackle Forecasting," *Globe and Mail*, 17 June 2007, S7; Nathan Vanderklippe, "Global Warming Jeopardizing Ice Highways," *Globe and Mail*, 30 May 2011, A3; Mark Blanchard, "Canada's Hottest New Weather Forecaster: 4DVAR: Supercomputer Improves Accuracy," *Globe and Mail*, 3 March, 2005, B10; Augusta Dwyer, "Meteorologist: Baby, the Rain Must Fall," *Globe and Mail*, 7 May 2003, C3.

103. Cormier, "The New Climate." See also Mitchell, "The Northwest Passage Thawed"; Martin Mittelstaedt, "Warming Trend Risks Plunging Cities Under Sea, Research Shows," *Globe and Mail*, 24 March 2006, A12; Martin Mittelstaedt, "Antarctic Ice Sheet Shrinking Rapidly," *Globe and Mail*, 14 January 2008, A13; Weber, "Canadian Scientists Discover New Clues to Rapid Arctic Ice Melt."

104. Alanna Mitchell, "Medieval Harvests Reveal Climate Change," *Globe and Mail*, 18 November 2004, A11; Zinta Zommers, "Predicting Future Climate Change May Lie in the Past," *Globe and Mail*, 21 March 2013, Factiva (GMBN000020130322e93l000b5); Paul

article explained how meteorologists' measurements and modeling of cloud volumes had improved over time, why the problem was so complex, and its importance for achieving more accurate weather forecasts.[105] Another explained how six centuries of annual reporting of the start date of the Pinot grape harvest in France were helping to evaluate and further develop climate change models:

> ... the harvest dates, worked backward through complex mathematical models, can be used to figure out variations in temperature, compared to the reference period of 1960 to 1989 — and not just for a few years, but in the longest uninterrupted line known in which the actual dates are written down. (The findings jibe with more complex global temperature models such as those derived from tree rings and ice cores.)[106]

The *Globe and Mail's* treatment of peak oil theory was much more superficial than its coverage of meteorology and climate change science.[107] It did not provide an account of the main elements of this body of scientific theory and its methodologies, nor did it acknowledge or explain the theory's evolution over many decades, or how it has been used in the oil industry. No article described peak oil theory in more than one or two sentences, and much less attention was given to reporting on new empirical data than in the case of climate change and meteorology. Historical information provided in *Globe and Mail* articles on peak oil theory did not extend beyond short references to Hubbert's 1956 paper.[108] There was no discussion of creaming curves or other approaches that analyzed patterns of oil discovery, even though these are crucial elements of peak oil theory today. The development of net energy analysis and the concept of EROI were ignored, even though they are essential to understand, among other things, why oil sands production is inherently much more expensive than conventional oil production. It was a letter to the editor from a *Globe and Mail* reader that presented this concept. The

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Taylor, "A Hawkeyed Addition to Canada's Arctic Arsenal," *Globe and Mail*, 10 December 2007, A3; Chantaie Allick, "U.S. Weather Satellites Run into Budget Storm," *Globe and Mail*, 18 July 2011, A15; Mitchell, "Northwest Passage Thawed; Andy Pasztor, "Communications: Low-Cost Satellites on Horizon," *Globe and Mail*, 31 December, 2007, B5; Mark Hume, "River Delta's Rise Puts Arctic's Future in Flux," *Globe and Mail*, 4 April 2008, A3; Mark Hume, "Undersea Vents a 'Time Machine' on Climate Change," *Globe and Mail* 18 February 2012, Factiva (GMBN000020120219e82i0008d).

105. Ian Popple, "Accurate Weather Forecasts? We're on Cloud Nine," *Globe and Mail*, 7 August 2004, F3.

106. Mitchell, "Medieval Harvests Reveal Climate Change."

107. It has been argued that the Canadian mass media's coverage of climate change still was not sufficient to give readers an adequate understanding of the nature of the problem. See Michael R. Harrison, "The Media and Public Perceptions of Climatic Change," *Bulletin of the American Meteorological* Society 63, 7 (1982): 730-730.

108. The most extensive coverage of Hubbert's work offered in the *Globe and Mail* was in Barrie McKenna, "Welcome to the Age of Scarcity," *Globe and Mail*, 21 May 2005, B15.

reader complained that "nowhere . . . did I see mention of the energy in/energy out ratio that underpins the entire peak oil debate."[109]

The *Globe and Mail* also treated scientists involved in peak oil research differently from those engaged in climate change science or meteorology. Scientists in the latter two groups were portrayed in a positive manner, as respected authorities, and their views were never juxtaposed with those of climate change deniers. In the case of peak oil, however, the *Globe and Mail* consistently juxtaposed statements of support for peak oil theory with statements of opposition—essentially from peak oil deniers—who were mostly spokesmen linked to oil industry interests. These opponents were most often portrayed in positive terms, as (neutral) experts, even if they had no scientific background and were not neutral. Daniel Yergin of IHS CERA, for example, with no degree in science or economics,[110] and serving as a consultant and lobbyist for oil industry interests[111] was presented as "a highly respected authority on energy, international politics, and economics."[112] In only very few instances did *Globe and Mail* journalists question the motives of the spokesmen who conveyed opposition to peak oil theory.[113]

109. Christopher Kevill, "It's All in the Ratios," *Globe and Mail*, 28 May 2005, B7. The *Globe and Mail*, instead of looking at EROI, refers to "cheap oil" and "expensive oil," but this shorthand does not adequately convey what is at stake in the shift from conventional to unconventional oil resources, and what happens when it takes more than a barrel of oil equivalent of energy to produce a barrel of oil. One *Globe and Mail* article uses the term "energy intensity" in a way equivalent to EROI, but does not link this to peak oil theory.

110. Former BP geologist, Richard Miller, who co-edited the peak oil theme issue of the Philosophical Transactions of the Royal Society, referred to Yergin as a "rubbish scientist," saying, "I'm not convinced that he has grasped the underlying science of anything." See Steve Andrews, "The Future of Oil Supply: An Interview with Dr. Richard G. Miller," 17 February 2014, at: http://peak-oil.org/2014/02/the-future-of-oil-supply-an-interview-with-dr-richard-g-miller/, accessed 16 April 2015.

111. Eric Reguly, "Petroleum: Oil Woes Sparking Healthy Debate," *Globe and Mail*, 20 October 2005, B2. Reguly assessed Yergin as "probably the most influential oil consultant in the United States."

112. "As world energy demand rises, so do questions of supply," *Globe and Mail*, 13 April 2010, WEC3.

113. CERA, for example, was involved in lobbying the U.S. Securities and Exchange Commission to change the rules for oil companies to report their "proved oil reserves," so as to make it easier to include unconventional oil sources as part of these reserves. See Barrie McKenna, "Energy: Rules Undervalue Reserves, Report Says," *Globe and Mail*, 24 February 2005, B11. IHS CERA was also evidently doing promotional work in its "Oil Sands Dialogue Study" on "Oil sands economic benefits: today and in the future," which was discussed in the *Oil and Gas Journal*, 11 February 2014, available at: http://www.ogj.com/articles/2014/02/ihs-canada-s-oil-sands-an-economic-boon-for-jobs.html, accessed 16 April 2015. IHS CERA would be unlikely to undertake reports like this without compensation. See also Danielle Droitsch, "Report to EU Commission Confirms Oil Sands Are High-Carbon Fuel Source," 9 February 2011, available at the Pembina Institute's website, http://www.pembina.org/blog/497, accessed 16 April 2015.

The *Globe and Mail*, in contrast to its positive treatment of meteorology and climate change researchers, portrayed peak oil theorists negatively. Not every journalist or article did this, but the balance was decidedly toward negative attributes.[114] Hubbert was characterized as "an End Times prophet" of a "peak oil apocalypse."[115] "Peakists" in general were portrayed as nonsense sayers, hysterical pessimists, or as a radical fringe, part of a "carbon cult." Articles referred to "oil-peak fanatics," a "lunatic fringe," "limits-to-growth doomsayers," "cranks," "petro-pessimists," and people "blathering about peak oil."[116] One journalist complained, "the claims of the doomsayers are too hyperbolic and hysterical."[117]

A 2001 review of Princeton geologist Kenneth Deffeyes's book, *Hubbert's Peak: The Impending World Oil Shortage*, penned by *Globe and Mail* energy reporter David Parkinson, provides an example of the derisive tone that permeated many articles and columns about peak oil. In the first two paragraphs of the review, Parkinson set a dismissive tone by commenting that, when Hubbert first proposed his theory at a meeting of the American Petroleum Institute,

> he may as well have stood at the podium with his pants around his ankles... Many experts dismissed Hubbert as a crackpot, another Chicken Little in an industry that had proved many a doomsayer wrong before.[118]

Parkinson labeled those who built on Hubbert's work, like Deffeyes, as "true believers" and "disciples" engaged in "the resurrection of Hubbert's controversial statistical methods." Parkinson's review sent the message that theorists like Hubbert and Deffeyes were ivory tower types who could be ignored. (He failed to mention that Deffeyes served as a consultant in

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114. Few *Globe and Mail* articles showed strong support for peak oil theory (and some of these were not written by *Globe and Mail* journalists). Most articles treated peak oil ideas with reticence, gave equal weight to views pro and con, and a significant number engaged in active derision or evinced hostility to the notion that there could be any fundamental problem with oil supply in the foreseeable future.

115. Neil Reynolds, "A Peak Oil Technocrat Ignored the Power of Technology," *Globe and Mail*, 5 October 2011, B2.

116. Fabrice Taylor, "Take Your Lumps; Looking for a Portfolio Alternative to Oil? Forget Wind, Solar and Hydrogen. The Future is Coal," *Globe and Mail*, 24 February, 2006, B23; Eric Reguly, "Two Barrels of Oil Are Used for Each One Found, $100 Oil Anyone?" *Globe and Mail*, 23 September 2007, B13; Shawn McCarthy, "Oil and Gas: As Prices Tumble, Doomsayers Hold Fast to Prophecy," *Globe and Mail*, 16 September 2006, B5; Matthew Ingram, "Crude Oil Price Surge Sends Shivers Down Investors Spines," *Globe and Mail*, 8 May 2004, B1; Anwar Haris, "Supply; Are Saudi reserves drying up?" *Globe and Mail*, 21 May 2005, B19; Harry Koza, "Amaranth May Be the Start of an Ugly Unwinding," *Globe and Mail*, 22 September 2006, B14.

117. Doug Saunders, "The World's Losing Its Workers – How Will We Compete?," *Globe and Mail*, 11 February 2012, F9.

118. David Parkinson, "What You Gonna Do When Your Well Runs Dry?" *Globe and Mail*, 27 October 2001, D6.

the 1970s and 1980s, establishing a program "that drilled for natural gas across western New York and northern Pennsylvania" with a high success rate.) Parkinson admitted that he could not understand Deffeyes's analysis, but had no qualms in concluding that it had little to do with the real world:

> He trots out a baffling array of charts and graphs and statistician's devices to explain how he reached his prediction. Only a reader with university-level proficiency in statistics will be able to decipher this analysis. . . . The two chapters dedicated to this statistical mosaic create the distinct impression that Deffeyes's prediction, flowing from Hubbert's methods, bears little resemblance to the real world; it's an interesting dot floating in two-dimensional space.[119]

The review concluded with Parkinson chiding Deffeyes for being "much less nimble with real-world implications than he is with fancy graphs."

One factor shaping the *Globe and Mail's* negative depiction of peak oil theorists was the explosion of popular concern about peak oil that occurred after the turn of the millenium, which in turn gave rise to pessimistic books, websites, and groups promoting lifestyle changes, to prepare for a future with scarcer fossil fuels and greater economic and political volatility.[120] Of course, climate change science has also given rise to similar environmental activism, promotion of lifestyle changes, and popular pessimism. Yet in the case of climate change, the *Globe and Mail* differentiated between those who created the science and the non-scientists who popularized it or mobilized it for purposes of political activism and social change. It never equated pessimism in climate change science with cultish doomsaying, even though many of the scientific prognoses were incredibly pessimistic. The *Globe and Mail* reported on scientific studies that forecast horrendous storms, massive devastation from coastal flooding—enough to "place dozens of major cities under water," but also the drying up of rivers and lakes, drought and famine that would affect billions of people, and widespread extinction of species.[121]

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119. Ibid.

120. On peak oil activism, see Matthew Schneider-Mayerson, "From Politics to Prophecy: Environmental Quiescence and the 'Peak-Oil' Movement," *Environmental Politics* 22, 5 (2013): 866-882.

121. See the following articles by journalist Martin Mittelstaedt: "Climate Change May Bring 'Supercanes,' Experts Say," *Globe and Mail*, 20 September 2003, A20; "Devastating Floods Seen from Global Warming"; "How Global Warming Goes Against the Grain," *Globe and Mail*, 24 February 2007, A8; "Climate Change: Unprecedented Heat Will Trigger Global Food Crisis," *Globe and Mail*, 9 January 2009, A4; "Effects of Warming Could Inundate Planet," *Globe and Mail*, 4 April 2007, A5. See also Gloria Galloway, "Violent Arctic Storm from 1999 a Climate-Change 'Harbinger', Study Says," *Globe and Mail*, 17 May 2011, A6; Mark Hume, "How Do We Fight Disappearing Rivers? Global Warming Is Drying Up Bodies of Water, Stranding Fish with No Way to Swim to Their Spawning Grounds," *Globe and Mail*, 20 October 2007, Factiva (GLOB000020071020e3ak0000p).

One study concluded that by around 2050, "the best wheat-growing land in the wide arc of fertile farmland stretching from Pakistan through Northern India and Nepal to Bangladesh" would be "decimated" and that "cereals and corn production in Africa are at risk, as is the rice crop in much of India and Southeast Asia,"[122] while other studies forecast that the Canadian prairies "may become a wasteland," a "dust bowl."[123] A prominent climate change scientist was quoted as saying, "If we follow 'business-as-usual' growth of greenhouse gas emissions... all hell is going to break loose."[124]

The comments and forecasts in leading publications by peak oil scientists are tame in comparison. A very important article published in *Scientific American* in 1998 by Colin J. Campbell and Jean Laherrère, both retired professional geologists who spent their careers working in major oil companies, offered no doomsday scenario. Projecting a global peak in conventional oil production to occur before 2010, Campbell and Laherrère observed that, "with sufficient preparation," the "transition to the post-oil economy need not be traumatic." In the Deffeyes book discussed above, no doomsday scenario can be found. Distancing himself from those who advocated "that we should eat only organic food and ride bicycles" he preferred to face the global oil peak "cheerfully and try to cope with it in a way that minimizes problems in the future." Doomsaying was likewise absent from the 2014 theme issue on peak oil of the *Philosophical Transactions of the Royal Society*. And if we go back to the original "End Times prophet of the peak oil apocalypse," we find that Hubbert's 1956 paper forecast a bright (nuclear) future, concluding that nuclear power offered "an energy supply adequate for our needs for at least the next few centuries of the 'foreseeable future'."

The *Globe and Mail's* negative portrayal of peak oil theorists, combined with its framing of the topic as a controversial hypothesis that pitted an ivory tower fringe group against practical and respected oil experts, had an important repercussion. These discursive techniques opened the door to articles that proposed a blanket rejection of peak oil theory (or even of oil depletion). A large headline in 2006 on the first page of the business section announced, "Peak oil theorists don't know Jack."[125] Although "Jack" referred to an offshore oil field, readers could hardly miss the latent message, which the article sought to reinforce. In 2007, columnist Neil Reynolds asserted that the "peak oil hypothesis" was "demonstrably

122. Mittelstaedt, "How Global Warming Goes Against the Grain."
123. Alanna Mitchell, "Prairie Today, Desert Tomorrow?," *Globe and Mail*, 7 October 2000, A14.
124. Cormier, "The New Climate."
125. Patrick Brethour, "Energy: Peak Oil Theorists Don't Know Jack," *Globe and Mail*, 6 September 2006, B1.

wrong—and is vigorously proven wrong year after year."[126] Responding unhappily to this article, a reader chided, "oil is a non-renewable resource. If we keep burning it, it will run out. We can debate whether that will occur in 20 or 200 years, but the need to wean society from oil should be beyond reasonable debate."[127] Similar articles and commentaries nevertheless continued to appear. Patrick White told readers in 2008, "the science of predicting peak oil is still a matter of crystal balls and crackpot formulas." David Berman wondered if peak oil would prove to be "just a fantasy." A 2010 column went further, asserting, "There is no peak oil." And Margaret Wente confidently informed readers in 2012, "the very idea of peak oil is now obsolete."[128]

Journalists' rejection of peak oil theory relied for support not upon scientific research but rather upon comments by peak oil opponents, and sometimes even upon misrepresentation of those comments. *Globe and Mail* energy reporter Dave Ebner misleadingly informed readers in 2005 of an IHS CERA report on peak oil, asserting that it "doesn't see a peak at all."[129] Columnist Neil Reynolds misrepresented the position of IHS CERA's Daniel Yergin, claiming that Yergin foresaw "not a finite peak but a never-ending plateau." Reynolds concluded:

> Global oil production is still on the rise with no evident decline any time in this century. We should take a moment to acknowledge this fact. It's not only that resurgent oil and gas reserves have abruptly extended the world supply of fossil energy for another 100 years. It's that market economics has again triumphed over the Luddite left...[130]

In fact Yergin has acknowledged that oil is a finite resource, and he did not dispute that global crude oil production will peak and decline. In a 2004 article in the *New York Times*, Yergin explained that he did "not deny that a peak will eventually be reached."[131] And IHS CERA's plateau hypothesis—which Yergin publicly promoted, projected that peak to

126. Neil Reynolds, "Petroleum: 'Peak oil' Doomsayers Fall Silent as Reserves Grow Ever Larger," *Globe and Mail*, 11 April 2007, B2.
127. Tony Manera, "Now Not Later," *Globe and Mail*, 12 April 2007, A16.
128. Patrick White, "Shades of Gloom: Peakniks and Doomers," *Globe and Mail*, 7 March 2008, L2; David Berman, "An Energy Vision That May Be Too Ambitious," *Globe and Mail*, 16 May 2009, B4; Neil Reynolds, "Economics: There is No 'Peak Oil'," *Globe and Mail*, 23 June 2010, B2; Margaret Wente, "Strange Bedfellows Want the U.S. to Step Up to the Plate," *Globe and Mail*, 19 November 2012, Factiva (GMBN000020121119e8bi0008d).
129. Dave Ebner, "How's This for Contrarian: World Now Facing Oil Glut," *Globe and Mail*, 22 June 2005, B8.
130. Neil Reynolds, "A Peak Oil Technocrat Ignored the Power of Technology," *Globe and Mail*, 5 October 2011, B2.
131. Daniel Yergin, "Imagining a $7-a-Gallon Future," *New York Times*, 4 April, 2004, WK1,WK7.

occur by the mid-21st century, well before 100 years of abundance proclaimed by Reynolds.[132]

Constructing Ignorance by Omission

As Margaret Atwood reminds us, "Ignoring is not the same as ignorance, you have to work at it."[133] For *Globe and Mail* journalists reporting on peak oil, working at it meant choosing to frame this as a story about a controversial hypothesis rather than as a story about the growth of knowledge about oil depletion. The journalists thereby built a particular structure of ignorance that was transmitted to readers (who might or might not accept it). The *Globe and Mail* also constructed ignorance about peak oil theory from three types of omission. In these cases, either nothing was transmitted to readers, or certain things either were or were not transmitted in certain sections of the paper.

The newspaper's projection of peak oil theory as "crackpot formulas" depended on omission of information about the many mainstream organizations and groups that embraced this theory, used it, or took its concerns seriously. One important group was the major oil companies. Insiders or CEO's of the six largest commercial, non-OPEC oil companies—ExxonMobil, BP, Shell, Chevron, Total, and ENI—have supported peak oil theory. CEOs of Shell, Total,[134] Chevron, and ENI have directly and publicly announced their acceptance of it,[135] while ExxonMobil CEO Lee Raymond, following his retirement, implicitly did so.[136] At BP, geologist Richard G. Miller was assigned by the company to head a large project from 1991 to 2008 to develop new forecasts of global oil production, and it was this project that pushed Miller to take up peak oil theory and contribute to its growth and diffusion following his

132. CERA developed its 'undulating plateau' model years before publishing a discussion of the model in 2014 in the *Philosophical Transactions of the Royal Society*. See "CERA Study: Oil Production to Track 'Undulating Plateau'," *Oil and Gas Journal*, 27 November 2006, 32-33.

133. Margaret Atwood, *The Handmaid's Tale* (Boston: Houghton Mifflin, 1986), 56.

134. Eric Reguly, "Total's 95 Theory," *Globe and Mail*, 18 May 2009, B1.

135. Reguly, "Total's 95 Theory"; Peter Beaumont and John Hooper, "Energy Apocalypse Looms as the World Runs Out of Oil," *The Observer*, 26 July, 1998. Oil industry CEO statements relating to peak oil have been compiled by Sohbet Karbuz, "Opinions of Oil Company Executives on Peak Oil," 11 November 2007, available at: http://karbuz.blogspot.ca/2007/11/opinions-of-oil-company-executives-on.html, accessed 17 April 2015.

136. Bhushan Bahree, "Oil and Gas: U.S. Petroleum Industry Sounds the Alarm," *Globe and Mail*, 16 July 2007, B5. Raymond chaired a committee commissioned by the U.S. Government in 2007 to carry out a study on global oil supply. The final report, "Facing the Hard Truths About Energy," took stock of peak oil theories and concluded, "World oil and gas supplies from conventional sources are unlikely to keep up with rising global demand over the next 25 years." The report is available at: http://www.npchardtruthsreport.org/, accessed 17 April 2015.

retirement, as discussed earlier. The *Globe and Mail* did report in 2009 that Total was organizing its planning around the idea that "global production will top out at 95 million barrels a day after 2020,"[137] and it reported on Lee Raymond's participation in a study on future oil supplies, but it did not report the peak oil views of the other oil companies mentioned above.

Two of the most important organizations that track global oil production statistics are the Energy Information Administration (EIA), a U.S. government agency, and the International Energy Agency (IEA), an arm of the OECD. Many governments use IEA statistics for energy policy planning. The perspectives of these two entities on peak oil theory are thus quite significant. The IEA's main spokesman was its chief economist Fatih Birol, and the *Globe and Mail* cited him as an expert opposing peak oil theory, but did not report his public statements (since 2011) demonstrating firm support for this theory. Interviewed by the Australian Broadcasting Company, Birol asserted, "We think that the crude oil production has already peaked in 2006. The existing fields are declining sharply in North Sea, in United States, in Gulf of Mexico. Just to stay where we are today we have to find four new Saudi Arabia's, this is a tall order."[138] In the case of the EIA, the *Globe and Mail* did not report that its website includes a global peak oil forecast done "very much in the spirit of King Hubbert's" or that the website tracks which countries around the world have passed peak oil production and moved into the decline phase of crude oil production.[139]

National governments and their militaries are also mainstream institutions concerned about oil supply, but the *Globe and Mail* has generally not reported on their interest in peak oil theory. It did not report on the French government's peak oil study, or on the British Parliament's "All Party Parliamentary Group on Peak Oil and Gas," which hosts a website and organizes lectures and other informational activities. It did not report on hearings about peak oil held by both the U.S. House of Representatives and the Senate, or on peak oil studies sponsored by the Department of Energy and the U.S. Government Accountability Office. Nor did it report on studies by the U.S. military and the German

137. Reguly, "Total's 95 Theory." On Miller, see Steve Andrews, "The Future of Oil Supply: An Interview with Dr. Richard G. Miller," 17 February 2014, available at: http://peak-oil.org/2014/02/the-future-of-oil-supply-an-interview-with-dr-richard-g-miller/, accessed 16 April 2015.

138. Jonica Newby, "Oil Crunch," *Australian Broadcasting Company*, "Catalyst," 28 April 2011, available at: http://www.abc.net.au/catalyst/stories/3201781.htm, accessed 16 April 2015. Birol was cited opposing peak oil theory in 2005, in Patrick Brethour, "Only Conservation Efforts Will Keep a Lid on Energy Costs," *Globe and Mail*, 3 December 2005, B6.

139. http://www.eia.gov/pub/oil_gas/petroleum/feature_articles/2004/worldoilsupply/oilsupply04.html, accessed 16 April 2015.

Bundeswehr that accepted peak oil theory and concluded that a global oil production peak was a near-term prospect.[140]

The foregoing examples do not fully convey the breadth and depth of interest in peak oil ideas among groups in mainstream society—financial and business circles,[141] organizations like the IMF, municipal governments, and professions such as architecture, urban planning, health care, and farming. Only by leaving this kind of information off of its news reporting agenda could the *Globe and Mail* maintain its depiction of peak oil theory as an intellectual sideline. In contrast, Michael Kumhof, an economist who co-authored a paper for the eminently mainstream IMF, argued that it was "highly unscientific, even irresponsible" to ignore peak oil.[142]

Patterns of omission in the *Globe and Mail's* coverage of peak oil are partly a facet of the newspaper's organization. To explain, we must bear two things in mind. First, since peak oil theory implies the need for

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140. Adam Porter, "'Peak oil' Enters Mainstream Debate," *BBC News*, 10 June 2005, available at: http://news.bbc.co.uk/2/hi/business/4077802.stm, accessed 17 February 2015. See also: http://appgopo.org.uk/index.php?option=com_frontpage&Itemid=1, accessed 16 April 2015; http://www.peakoil.net/Aleklett/Hause_Peak_Oil_hearing_2005.pdf, accessed 16 April 2015;
http://old.globalpublicmedia.com/us_senate_committee_hearing_on_peak_oil, accessed 16 April 2015; http://www.gao.gov/new.items/d07283.pdf, accessed 16 April 2015; Terry Macalister, "US Military Warns Oil Output May Dip Causing Massive Shortages by 2015," *The Guardian*, 11 April 2010, at:
http://www.theguardian.com/business/2010/apr/11/peak-oil-production-supply, accessed 16 April 2015; Stefan Schultz, "'Peak Oil' and the German Government: Military Study Warns of a Potentially Drastic Oil Crisis," *Der Spiegel*, 1 September 2010, at:
http://www.spiegel.de/international/germany/peak-oil-and-the-german-government-military-study-warns-of-a-potentially-drastic-oil-crisis-a-715138.html, accessed 16 April 2015.

141. Kate Mackenzie, "Wall St and Peak Oil," available at:
http://dev.energybulletin.net/node/53459, accessed 16 April 2015. An important example of interest in peak oil theory in financial circles was the prominent Texas energy banker Matthew Simmons, who spoke publicly about peak oil and served as energy advisor to George W. Bush. See Simmons' book *Twilight in the Desert*. See also Cyrus Sanati, "Matthew Simmons, Noted Energy Banker, Dies at 67," *New York Times*, 9 August 2010, at: http://dealbook.nytimes.com/2010/08/09/matthew-simmons-noted-energy-banker-dies-at-67/, accessed 16 April 2015. Examples of business acceptance of peak oil theory are Toyota and Volvo, who have brought peak oil ideas into their planning. See interview with Jim Lentz, the CEO of Toyota North America at:
https://www.youtube.com/watch?v=yVEZE2vM2oM, accessed 16 April 2015; and a Volvo brochure discussing peak oil at:
http://www.volvogroup.com/sitecollectiondocuments/volvo%20ab/values/environment/future_fuels_large,eng.pdf, accessed 16 April 2015.

142. Matthieu Auzanneau, "Peak Oil Warning From an IMF Expert: Interview with Michael Kumhof," *Le Monde*, 5 December 2012, at:
http://petrole.blog.lemonde.fr/2012/12/05/peak-oil-warning-from-an-imf-expert-interview-with-michael-kumhof/, accessed 16 April 2015.

material reorganization of society's infrastructures and ways of functioning, the question of how and when this reorganization should be undertaken is a matter of broad public importance. One would therefore expect to see the topic addressed in the paper's front pages, in the A section. Second, interest in peak oil exploded in the 21st century in part because oil and gasoline prices soared. Whereas oil prices had declined from 1979 to 1999,[143] they rose sharply between 1999 and 2011, from $10 per barrel to over $100 (more than a 1000% increase),[144] with a price spike in 2008 to over $130 per barrel. The pattern of change was dramatic enough that the *Globe and Mail* staff concluded that something major was happening. Editor-in-chief Edward Greenspon explained:

> ... as oil prices began edging into the $50 (U.S.) range, ... we came to the conclusion that something fundamental is indeed occurring in the energy market as traditional supplies of oil run down and economic development stokes demand in the world's two most populous countries, China and India.[145]

Greenspon decided to launch a week-long, in-depth series on oil, "Crude Awakening," which appeared the following May (2005). It included coverage of peak oil views, and was published in the business section (B) of the newspaper.

Rising oil prices were covered in the front pages of the A-section of the newspaper, but without mentioning the fundamental supply issues often discussed in the B-section. Front-page articles on oil and gas prices (about 30 articles between 2000 and 2011) did not refer to "peak oil," "oil depletion," or indeed to any fundamental oil supply issue. None of these articles mentioned, for example, that oil production from the North Sea (UK, Denmark, and Norway) had peaked 1999 and dropped nearly 40% by 2009, a decline of more than 2 million barrels per day. (In contrast, Canadian oil sands production still remained under 1.5 million barrels per day in 2009.) The articles on the front page of the A-section did not mention the sixteen countries whose crude oil production peaked between 1995 and 2005 (more than four times the number of countries that experienced a peak oil shift in the period from 1970 to 1995). Not a single article on the front page mentioned that OPEC could no longer maintain its traditional role of stabilizing world oil prices by voluntarily altering production levels, because its spare capacity had "dried up."[146] None

143. From 1979 to 1999, oil prices declined from a nominal price of $40 per barrel to $10, or, when measured in 2014 dollars, even more sharply, from around $116 per barrel in 1979 to $10 in 1999.

144. These figures are roughly applicable to both nominal and adjusted oil prices, since the difference between them over this period was small.

145. Edward Greenspon, "Being About More than Yesterday: Letter from the Editor," *Globe and Mail*, 21 May 2005, A2.

146. Bhushan Bahree, "Energy: OPEC Unable to Control Prices as Its Spare Capacity Dries Up," *Globe and Mail*, 4 August 2004, B5.

mentioned that Indonesia had to end its membership in OPEC because its oil production was declining to the extent that it became a net oil importer in 2004. None mentioned that the price of discovering and producing new oil sources was systematically increasing by 10% per year from 1995 to 2005 for non-OPEC producers. None mentioned, either, that total oil production by the "supermajors"—ExxonMobil, BP, Shell, Chevron, and Total—was declining from 2004, that the decline rates were increasing over time, and that their reserves were moreover declining relative to their diminishing production. The front pages of the A section of the *Globe and Mail,* in short, ignored a lot.[147]

Instead of basic oil supply factors, the reasons provided by the *Globe and Mail* in its leading A-section articles to account for higher crude oil prices were political and emotional factors mixed in with a hodge-podge of other causes: "Strike in Venezuela; fear of Iraqi war" (December 2002); "the killing of five Western oil workers in Saudi Arabia" (May 2004); "threat of sabotage by Shia militants" (August 2004); Nigerian rebels causing "fear of disruption to shipments of crude oil" (September 2004); "generational issues involving the Saudi throne;" "concerns about terrorism in the Arabian Peninsula, rising oil demand in Asia, stretched supplies, and the indifference of North American consumers to high pump prices" (August 2005); "escalating tensions over Iran's nuclear program" (April 2006); "speculative money being poured into the oil market" (April 2006); "intense violence in Lebanon" (August 2006); violence in Nigeria and Algeria, rising tensions in Pakistan, North Korea, and Kenya, and colder weather in the Northeastern United States (January 2008); "reports showing inventories of crude in the United States at a two-year low" (January 2008); "the shutdown of a small refinery in Texas after an explosion" and a "battle between Venezuela and Exxon Mobil Corp" (February 2008); the uprising in Libya combined with Asian and South American countries who were "hungry for fuel" (May 2011).[148] If these

147. Jeffrey J. Brown & Samuel Foucher, "Peak Oil Versus Peak Exports," (October 2010), available at: http://www.resilience.org/stories/2010-10-18/peak-oil-versus-peak-exports, accessed 17 April 2015. See also Eric Reguly, "Inexpensive Oil Vanishing at an Alarming Rate," *Globe and Mail*, 14 December 2013, B1; Stuart Burns, "After the BP Gulf Oil Spill, What Next For US Energy?" *MetalMiner*, 16 June 2010, at: https://agmetalminer.com/2010/06/16/after-the-bp-gulf-oil-spill-what-next-for-us-energy/, accessed 17 April 2015; Stuart Staniford, "Tar Sands Production Graph," at: http://earlywarn.blogspot.ca/2010/01/tar-sands-production-graph.html, accessed 17 April 2015; Bhushan Bharee, "OPEC Unable to Control Prices As Its Spare Capacity Dries Up," *Globe and Mail*, 4 August 2004, B5; Eric Reguly, "Falling Production to Inevitably Alter Big Oil's Playing Field," *Globe and Mail*, 13 April 2009, B1.

148. Patrick Brethour, "Climbing Oil Prices Set to Hit Home," *Globe and Mail*, 31 December 2002, A1; Patrick Brethour, "Gasoline Prices at Record High," *Globe and Mail*, 5 May 2004, A1; Michael Georgy, "Oil Nears $49 Amid Iraq Fears," *Globe and Mail*, 20 August 2004, A1; Jill Mahoney, Dawn Walton, and Patrick Brethour, "$50 Oil: As Record Falls, 'It's Great to be in Alberta'," *Globe and Mail*, 28 September 2004, A1; Mark

price rise explanations—pointing mainly as they did toward fears and political tensions—were tenable, then we should expect oil price *declines* to be associated with easing of fears and tensions. Yet the dramatic oil price drop from the summer of 2014 to early 2015 was, on the contrary, accompanied by fears, rising tensions, and attacks in oil producing and oil transporting regions.

A third type of omission by the *Globe and Mail* concerned oil production statistics. In order to evaluate peak oil projections, it is essential to keep track of what is being measured, but the *Globe and Mail* often neglected to do so, and instead compared apples and oranges. Peak oil projections from the time of Hubbert up to the end of the millenium were generally based on production curves for crude oil alone. More recently, however, public statistics (e.g. from governments) have begun to aggregate crude oil with other liquids, including ethanol, tight oil, synthetic oil produced from Canadian tar sands, extra heavy oil, and natural gas liquids. Production of these other liquids has been increasing, so adding them all together with crude oil and calling the total "oil" suggests that crude oil production has been increasing. Stripping these other elements away reveals that global crude oil production reached a plateau around 2005 at around 75 million barrels a day.[149] Because of this shift in the definition used for the term "oil", it was easy to convey the impression that peak oil theory had been proved wrong, because "oil production" continued to increase despite projections that it would peak. Yet an estimate about conventional crude oil production cannot be invalidated by adding in things that were never part of the original estimate: ethanol production (made from corn or sugar cane), liquids from natural gas, synthetic oil made from coal or strip-mined bitumen, or oil produced by energy-intensive fracking in shale oil formations. Some *Globe and Mail* journalists, such as Eric Reguly, have paid attention to these distinctions and noted that world conventional crude oil production

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MacKinnon and Alan Freeman, "Saudi Rift Feared as King Dies," *Globe and Mail*, 2 August 2005, A1; Patrick Brethour and Katherine Harding, "Alberta May Get $7-Billion Surplus," *Globe and Mail*, 22 August 2005, A1, A7; John Heinzl, "Oil Prices, TSX Reach Record Highs," *Globe and Mail*, 19 April 2006, A1; Derek DeCloet, "Speculators Pouring Billions into Oil Market," *Globe and Mail*, 20 April 2006, A4; Patrick Brethour, "Refineries Better Able to Survive Storms," *Globe and Mail*, 30 August 2006, A3; Richard Blackwell and Roma Luciw, "The Economy; Global Shakeup Looms: Oil's March to $100 Marks Tipping Point," *Globe and Mail*, 3 January 2008, A1; Paul Waldie, Tara Perkins, and Wendy Stueck, "The Economy: Fuel Costs Predicted to Soar Past $1.30 in Months; Gas Prices Climbing as Oil at $100 Mark," *Globe and Mail*, 4 January 2008, A1; David Ebner, "Highest Close Ever: $100 Oil Adds Fuel to Fears on Economy," *Globe and Mail*, 20 February 2008, A1; Carrie Tait and David Berman, "Changes in Global Landscape Cause Oil Prices to Plummet," *Globe and Mail*, 6 May 2011, A1.

149. James Murray and David King, "Oil's Tipping Point Has Passed," *Nature* 481 (26 January 2012): 433-435; Richard A. Kerr, "Peak Oil Production May Already Be Here," *Science* 321, 2064 (25 March 2011): 1510-1511.

peaked.[150] But a larger number ignored the changed counting and the fact that this peak had occurred.

Overall, the *Globe and Mail* coverage makes it difficult (without going to outside sources) to recognize that conventional crude oil production did in fact peak. A 2006 headline told readers, "Fall in global oil supply not expected before 2030.[151] A column printed on the same page and the same day asserted, "we should now be confidently able to push back "peak oil" by a few hundred years."[152] A 2007 article reported the view of an expert that global peak oil had already been reached,[153] but later in the year, another article announced, "the great global debate over the peak oil thesis isn't settled yet."[154] A 2008 article on "peakniks and doomers" reported that some "insist that peak oil has already passed; some say it's 20 or 30 years off."[155] But the article did not explain that these projections differed mainly because they applied different definitions of "oil." Another 2008 article reported the views of a peak oil expert, who indicated that global conventional crude oil production had peaked in 2005,[156] but a couple of months later, readers were offered an "'exciting' reminder that the peak may still be a long way off," a realization that would "give any peak oil person bad heartburn."[157] A year after that, it was reported that the CEO of French multinational oil firm Total saw oil peaking in 2020.[158] In 2010 economist Jeff Rubin, in his column in the *Globe and Mail,* reported that new figures released by the International Energy Agency showed that conventional oil production peaked in 2006.[159] In 2011, an article noted,

150. Reguly, "Inexpensive Oil Vanishing at an Alarming Rate."
151. "Energy: Fall in Global Oil Supply Not Expected Before 2030," *Globe and Mail*, 15 November 2006, B2. This anonymous article conveys a statement by CERA.
152. Neil Reynolds, "Energy: Shale Offers U.S. Rock-Hard Fuel Prospects," *Globe and Mail*, 15 November 2006, B2.
153. Eric Reguly, "Combustible Mix Fuels Oil Price Rise," *Globe and Mail*, 3 April 2007, B2.
154. Fabrice Taylor, "Past the Peak; It's Getting Harder to Find Oil and Gas in the West—a Great Reason to Invest in Oil Field Services," *Globe and Mail*, 25 May 2007, Factiva (GLOB000020070525e35p00058).
155. Patrick White, "Shades of Gloom: Peakniks and Doomers," *Globe and Mail*, 7 March 2008, L2.
156. Shawn McCarthy, "Oil Peak Theorist Warns of Chaos, War," *Globe and Mail*, 8 April 2008, B3.
157. Barrie McKenna, "Record Prices Put Arctic Oil Within Reach; Resources the Oil Industry Thought Would Never Be Tapped May Soon Be Called into Play," *Globe and Mail*, 25 July 2008, B4.
158. Eric Reguly, "Plateau Theory Drives Total to Oil Sands," *Globe and Mail*, 16 May 2009, B1.
159. Jeff Rubin, "Even the International Energy Agency Expects Peak Oil Now; What are the Chances We'll Ever Be Able to Afford to Burn the Oil That We're Supposed to Find?" *Globe and Mail*, 24 November 2010, GMBN (*Globe and Mail* Breaking News), accessed through Factiva database.

"concerns that oil production is near peaking have subsided."[160] Margaret Wente went further in her column, advising readers to "Forget Peak Oil – we won't be there any time soon."[161] Eric Reguly complained in 2012, "we can debate until our gums bleed whether the world has reached, or is close to reaching, peak oil,"[162] but less than a week later another article quoted a financial expert who insisted the debate *was* over: "this unexpected boom in oil supply puts to rest the so-called 'peak oil' debate, where adherents to this theory argued that the supply of oil is fixed and dwindling..."[163] And as U.S. "tight oil" production continued to rise amidst growing hype, *Globe and Mail* journalists stopped reminding readers that global conventional crude oil production did in fact peak around 2005.

Despite the broad structure of the *Globe and Mail's* representation of peak oil theory, with its biases and omissions, it is possible to find many trustworthy articles written by journalists who have tried to provide readers with solid information about global oil production and peak oil. In researching this study, I compiled and tracked the individual journalists' articles on this subject, and found a few who stood out for their careful presentation of evidence, most notably Eric Reguly. Moreover, the factual coverage of oil industry and oil production matters in the *Globe and Mail* is impressive. The 2005 series, "Crude Awakening," for example, includes articles that are still worth reading.

The newspaper's current structure has contributed to diluting and weakening the impact of good reporting, however. In the 1940s, the *Globe and Mail* had no columnists. Today, it has many, chosen in part to reflect different political orientations. Politically oriented columnists spin the information they present, and several, like Neil Reynolds, representing the far right of free-market ideology, sometimes played loose with the "facts." Reynolds mounted an unrelenting attack on peak oil thinking, and a number of his columns contain incorrect or misleading statements. The rise of multiple sections also affected the coherence of *Globe and Mail* coverage of energy matters. In the 1940s, the *Globe and Mail* had only one section, but today it has multiple sections, which has opened the door to purveying divergent explanations of the same phenomena in different

160. Matthew Robinson, "Oil Near $100, But Surge Not Forecast; Crude Not Seen Soaring to $150 Again," *Globe and Mail*, 3 January 2011, accessed through Factiva (GMBN000020110103e713001jl).

161. Margaret Wente, "The Keystone Victory That Wasn't; Obama May Have Bought Himself a Reprieve with the Environmentalists, but Nothing Else Will Change," *Globe and Mail*, 15 November 2011, Factiva (GMBN000020120710e7bf003na).

162. Eric Reguly, "All the Signs Are Pointing to a Falling Oil Price – Except Supply," *Globe and Mail*, 3 March 2012, B1.

163. Michael Babad, "Why Ottawa Won't Let Air Canada 'Shut Itself Down'; Plus, 'Peak Oil' Debate Dead, BMO's Cooper Says," *Globe and Mail*, 9 March 2012, GMBN, accessed through Factiva (GMBN000020120309e839003xp).

sections of the newspaper. Some of the changes in the *Globe and Mail* have been beneficial. In the 1940s and 1950s, the *Globe and Mail* had fewer book reviews and none relating to oil industry matters. Today, much of the best coverage of peak oil issues in the *Globe and Mail* occurs through book reviews[164] or through contributions written by non-journalists, like Thomas Homer-Dixon[165] and Jeff Rubin.[166]

Mass Media and the Global Energy System: Explaining the Shape of Ignorance

Having examined how the *Globe and Mail* depicted peak oil as a controversial hypothesis, a realm of debate, and its proponents as a fringe group, we must now ask why these specific projections took root. Why did the *Globe and Mail* project the view that peak oil theory was a controversial hypothesis rather than an established, growing body of scientific knowledge and mathematical modeling methodologies? And why did it project a view of peakists as a pessimistic, cultish fringe of the intellectual and social world? Why did the fairly straightforward question of the timing of peak oil to turn into cacophony in the *Globe and Mail*?

An important starting point to answer these questions is to consider more carefully why leading newspapers like the *Globe and Mail* engage routinely in spin. The "propaganda model" of mass media elaborated by Edward Herman and Noam Chomsky in *Manufacturing Consent: The Political Economy of the Mass Media* proposes that mainstream media construct realities that are filtered by the corporate structure of the media, by the fact that media depend on advertising for revenue, and by the fact that corporations, high-ranking officials, political figures, and other "big" actors have more access to media and more opportunities to shape discourse and the conceptualization of issues. High-ranking officials in government or international organizations can shape discourse and create news in part because their rank makes their utterances newsworthy *in principle*. They can, for example, decide to hold press conferences that define issues in particular ways, telling both the media and public how certain events or issues should be understood. Corporations regularly seek

164. Reviews by independent journalist Andrew Nikiforuk provide a good example.

165. See, for example, Thomas Homer Dixon, "Unleash Canada's Capitalist Creativity on Global Warming," *Globe and Mail*, 21 October 2006, A25; "Oil; Has Production Peaked?" *Globe and Mail*, 6 August 2007, A11; "Essay; Fear, Itself: Make Room for Doom and Gloom," *Globe and Mail*, 4 April 2009, F7; "Our Fukushima Moment," *Globe and Mail*, 18 March 2011, A19.

166. See, e.g., Jeffrey Rubin, "The Real Story Behind Today's High Oil Prices Is the Lack of Production from Non-OPEC Producers," *Globe and Mail*, 5 February 2000, N2; "Why Sky-High Oil Prices Are No Blip on the Radar," *Globe and Mail*, 22 March 2004, B7; "Energy: State of U.S. Oil Supply Exposed by Unforgiving Mother Nature," *Globe and Mail*, 30 September 2005, B12.

to shape discourse about significant issues through direct advertising, but they also do so by generously funding their public information departments and lobbyists, and by regularly feeding information to the media. Equally important, corporations give large sums of money to think tanks and consulting firms (like IHS CERA) that develop and propagate ideas that mesh with corporate interests (and that may contribute to their lobbying efforts). Often these ideas are then picked up and diffused by the media. Herman and Chomsky also stress that many journalists internalize and accept the conceptual positions and points of view that leading political and economic actors advocate.

Viewed from the conceptual framework of the propaganda model, therefore, we expect that the *Globe and Mail*, as a Canadian "newspaper of record" owned by a large corporation, would tend to uphold the status quo. We expect that it would broadly support society's governance system, which in turn means accepting the legitimacy of the hierarchies that give certain individuals and entities preferential access to the media and that accord them a greater say in defining how particular issues should be understood and interpreted. Broadly supporting society's governance system means accepting that statements by CEOs and officials within government and major international organization *will* be given more credence than statements by individual scientists. And indeed we find numerous *Globe and Mail* articles offsetting or downplaying statements by peak oil theorists through comments by oil industry spokesmen or consultants.

Unlike peak oil theory, scientists' findings about climate change have been given increasing weight (and status) by the mass media over time because they have been formally channeled through the United Nations, a major actor in the global governance system and because the UN-sponsored IPCC brings together and consolidates views of literally thousands of highly placed scientists from around the world. In other words, climate science has been given weight because it represents a collective scientific voice that has been authorized by—and attached to—the authority of a major international organization. This is not yet the case with peak oil. The status of peak oil science has been increasing through its presentation in government-sponsored reports and its public acceptance by some large oil companies, etc., but the acceptance so far has been more fragmented and diffuse than for climate change science, with many forces still opposing peak oil's validation by the governance system.

Broadly supporting a society's governance system means that mass media like the *Globe and Mail* promote the assumption that "business as usual" will and should prevail. Supporting the status quo means accepting that the near and medium-term future will not deviate much from the present and certainly not in any radical or strongly negative ways. Yet peak oil theory—like the science of climate change—challenges such

assumptions: it suggests that the future will become different unless the current status quo is altered. Journalists' references to peakists as pessimists and doomsayers thus reflect hostility to this undesired message.

In attempting to account for the *Globe and Mail* coverage of peak oil, it is important to consider the interests and influence of major oil producers. Broad public discussion of peak oil poses several threats to oil companies. Such discussions can directly impact their business, their share prices, and make it harder for them to plan for the future. Investors who do not believe that oil production has a solid future might direct their money elsewhere, which in turn would affect oil companies' ability to attract the increasing levels of investment needed to launch new exploration and development projects. As journalist David Berman explained, "If you believe that production will either decline or stagnate in a decade or so, then investing in an [oil] producer doesn't sound like the best investment."[167] Alternately, the belief that oil is becoming scarce could propel speculators to intervene in markets, destabilizing prices, which also harms oil companies. Saudi Arabia's oil minister, quoted in a 2007 *Globe and Mail* article, blamed volatile oil prices on "pessimists, gurus, and experts preaching peak oil" who were "agitating the speculators."[168] If consumers in large numbers start believing that they cannot count on a secure, cheap oil supply in the future, millions will start changing their purchasing decisions and lifestyles now: those making new purchases will buy smaller cars, choose smaller homes in locations that minimize energy consumption and the need for driving, and families will have their children choose sports and activities that can be carried out close to home. The truth is, energy-intensive societies of rich countries offer numerous ways for people to decrease their use of fossil fuels. The oil crisis of the 1970s produced rapid and far-reaching changes in consumer behavior whose consequences lasted for years.

Even though oil producers themselves depend on peak oil theory, there are practical reasons for them to want to control public conversation about oil supplies and the oil production/consumption system. It is easiest for them if the millions of people who use their products take a business-as-usual view of the world, because predictable consumer behavior that follows oil-industry and government cues makes it easier for oil companies to plan and control their preferred path of change toward the future. Oil companies—and governments—also want to control the conversation in order to keep oil prices more stable than they might otherwise be. Oil prices that spike too much and too quickly can trigger cascades of changes that can drive down GDP and stifle demand. Oil price

167. David Berman, "An Energy Vision That May Be Too Ambitious," *Globe and Mail*, 16 May 2009, B4.

168. Dave Ebner, "Oil Prices Too High, Saudi Minister Says," *Globe and Mail*, 13 November 2007, B1.

rises from 2000 to 2008 brought warnings that they would lead to recession, and the price plunge that occurred in the fall of 2014 and winter of 2015 has been explained as a byproduct of demand destruction caused by the earlier price increases.[169] Yet when prices slump sharply as occurred in 2009 and 2014-2015, then oil companies cannot afford to invest in new production, which ultimately leads to lower supplies followed by another round of price rises. More generally, when oil supplies are constrained relative to demand, oil prices become increasingly volatile,[170] and public discussions of peak oil potentially exacerbate such volatility by more rapidly shifting consumer and investor behavior.

Despite oil companies' knowledge of and continued dependence on peak oil theory, some large oil companies have seen benefits in launching anti-peak oil ads or making vague assertions to the press about plentiful oil supplies and peak oil irrelevance. ExxonMobil, the world's largest oil company, put an ad in prominent newspapers that promised oil abundance: "Contrary to the theory, oil production shows no sign of a peak…A peak will not occur this year, next year or for decades to come…With abundant oil resources still available peak production is nowhere in sight." Yet as one skeptic noted, ExxonMobil's own oil reserves were shrinking, and new additions to ExxonMobil's reserves were mainly from gas rather than oil.[171] Some months after the ExxonMobil ads appeared, a *Globe and Mail* article with the headline, "Leading Producers Dismiss Peak Oil Theory," reported that Saudi Aramco and ExxonMobil were "aggressively arguing that plenty of crude oil remains for world consumption in an effort to counter critics who contend crude output is about to plateau."[172]The journalists in this instance suggested to readers that the pronouncements reflected vested interests. The article included a box with a quotation in large font, citing the words of the former chief economist of the OECD's energy arm, the IEA, who explained, "If you are sitting on the world's biggest oil deposits, you would want to prevent the premature development of alternatives to oil." Most such pronouncements published in the *Globe and Mail* from the oil industry and their consultants went unchallenged, however.

169. Michael Babad, "Oil's 'Hog Cycle' Smacks Canada; Economic Prospects Dim Along with Crude's Plunge," *Globe and Mail*, 16 January 2015, Factiva (GMBN000020150116eb1g001p5).

170. James Murray and David King, "Oil's Tipping Point Has Past," 34-35.

171. Ronald R. Cooke, letter to Rex Tillerson, CEO of ExxonMobil, 9 March 2006, posted at http://www.aspo-australia.org.au/general/ron-cooke-takes-on-exxon-s-claim-of-no-peak-oil-in-sight.html, accessed 17 April 2015.

172. Bhushan Bahree and Jeffrey Ball, "Leading Producers Dismiss Peak Oil Theory," *Globe and Mail*, 14 September 2006, B16.

The inevitable approach of peak oil and the uncertainties it raised placed oil companies in a quandary: maintaining the economic position of their companies demanded a rosy view, but their experience was becoming less rosy. Some oil executives and their publicity departments engaged in misinformation or outright lying to bolster public confidence in their companies, even as they faced decline through fewer, smaller discoveries, and steeper depletion rates (smaller oil fields decline more rapidly), and even as they shifted production toward costly, energy-intensive substitutes like Canada's oil sands to compensate for a lack of conventional oil deposits to tap. Royal Dutch Shell and its subsidiary Shell Canada provide a good example, In 2005, when the *Globe and Mail* published its series, "Crude Awakening," several oil companies wrote letters of response, seeking to steer the oil depletion conversation in preferred ways. The CEO of Shell Canada declared, "we see no reason to panic; we believe the world has abundant supplies of energy resources."[173] (Notice the CEO's choice of the word "energy" rather than "oil.") Despite this declaration of abundance, Royal Dutch Shell, the world's third largest multinational oil company, had just been forced to downgrade its stated estimates of its own oil reserves for the fifth time in little over a year, leading to an overall reduction of 5.8 billion barrels, equivalent to "more than six years of Canada's total crude production."[174] The scandal damaged the company's valuation, wiping £9 billion off its market value. It led also to the public release of an internal company email in which a top executive wrote that he was "sick and tired of lying" about the company's oil reserves.[175] Not only did Shell's reserves decline, however, but its oil production did as well. It peaked in 2003 and has declined ever since.[176]

In 2008, Shell finally gave up the charade and moved publicly into the peak oil camp. Jeroen van der Veer, the CEO of Shell Canada's parent company Royal Dutch Shell, sent an email to all employees in January 2008 stating, "the world's current predicament limits our maneuvering room. . . . Shell estimates that after 2015 supplies of easy-to-access oil and

173. Clive Mather, "Supply and Demand," letter to the editor, *Globe and Mail*, 28 May 2005, B7.

174. Eric Reguly, "Energy: Suicidal Shell's Best Hopes Lie in Slow-Growth Oil Sands," *Globe and Mail*, 8 February 2005, B2.

175. Terry Macalister, "Shell Admits It Misled Investors," *The Guardian*, 20 April 2004, 1. See also Brian O'Connor, "One Year On and Shell Is Struggling Towards a Sea Change," *Daily Mail*, 7 January 2005, ED_1ST_04 , Pg. 100, LexisNexis Academic.

176. Industry Taskforce on Peak Oil and Energy Security (ITPOES), *The Oil Crunch: Securing the UK's Energy Future*, 2008, 12, available at: http://www.igd.com/Documents/Industry%20Reports/Energy/The%20Oil%20Crunch.pdf, accessed 17 April 2015.

gas will no longer keep up with demand . . . ."[177] He went even further in a long interview published in a Shell magazine, where he asserted, "The peak oil theory, as it was first published by the old American Shell employee King Hubbert, is correct . . . But Hubbert did not . . . think of the oil sands in Canada. For the oil sands a peak oil theory can also be formulated, but for the moment we are still at the beginning of it."[178] Moving over to the peak oil camp did not mean that Shell stopped spinning reality to suit its own needs, however. Later in 2008, the UK Advertising Standards Authority ruled that Shell engaged in misleading advertising by claiming to support the lowering of greenhouse gas emissions when in fact it was engaged in ramping up production of bitumen in the Canadian oil sands, which accelerated CO_2 emissions.[179]

Another strategy corporations have used to control conversations important to their business interests is to fund outside entities like think tanks and consulting firms that actively intervene in policy conversations, steering them in ways that the corporations prefer. ExxonMobil has channeled millions of dollars to fund organizations opposing ideas of global warming, and we see a similar phenomenon with respect to peak oil. In fact, major organizations and spokesmen dismissing climate change have also been actively dismissing peak oil theory. Two examples (out of many) illustrate the point. First, the Committee for a Constructive Tomorrow (CFACT), an organization opposing climate change ideas, received donations of nearly $600,000 from ExxonMobil between 1998 and 2007. CFACT in turn sponsors two blogs, "Climate Depot" and "Energy Depot", which oppose, respectively, climate change ideas and peak oil ideas. Second, from 1998 to 2008, ExxonMobil gave over $600,000 to the Manhattan Institute,[180] a conservative think tank whose Senior Fellows Peter Huber and Mark T. Mills authored *The Bottomless Well: The Twilight of Fuel, the Virtue of Waste, and Why We Will Never Run Out of Energy*, published in 2005. The book espoused an economic message of eternal abundance through ingenuity that seemed to ignore the laws of thermodynamics: "We can economically dig, dam, pump, and

177. Jeroen van der Veer, "Shell Energy Scenarios," email sent to all Shell employees, 22 January 2008. The text of this email is available at: http://www.theoildrum.com/node/3548, accessed 17 April 2015.

178. Piet de Wit, Interview with Jeroen van der Veer, 27 January 2008. This interview was posted on leading peak oil websites. See: http://www.resilience.org/stories/2008-01-27/shell-executive-peak-oil-oil-prospects, accessed 17 April 2015

179. Toronto350.org, "The Fossil Fuel Industry and the Case for Divestment," 3 March 2014, 22-23. Available at: http://toronto350.org/divest/fossil-fuel-divest.pdf. Shell's misleading advertising debacle was also covered by journalist George Monbiot and published in *The Guardian*. See: http://www.monbiot.com/2009/01/06/shells-game/, accessed 17 April 2015

180. See: http://www.exxonsecrets.org/html/orgfactsheet.php?id=51, accessed 17 April 2015.

purify all the energy we like . . . with the rise of logic we attain the impossible–infinite energy, perpetual motion, and the triumph of power."[181] They further claimed, "the raw fuels are not running out. The faster we extract and burn them, the faster we find still more . . . energy supplies are infinite."[182] They argued, "the more energy we consume, the more we capture. It's a chain reaction, and it spirals up, not down. It is, if you will, a perpetual motion machine."[183] Not surprisingly, Huber and Mills dismissed "peak-oil cultists." Reflecting, in 2005, about how peak oil ideas were being received by society, they contended, "No one of any consequence listened to the doomsayers. Wall Street was unfazed. Investors poured money into Canada's vast fields of heavy oil. Saudi Arabia announced yet more reserves. The U.S. economy hummed right along."[184]

The ideas diffused by think tanks and consulting firms have influenced the way newspapers like the *Globe and Mail* portrayed peak oil theory—particularly their tendency to portray it as a controversial hypothesis rather than a growing body of scientific research. The lead article of the *Globe and Mail's* 2005 series "Crude Awakening," which gave a perfunctory synopsis of Hubbert's ideas, juxtaposed it with comments by Peter Huber (co-author of *The Bottomless Well*), who asserted that "wasting energy" was "a virtue, not a vice, because the faster we use it up, the better we get at finding new supplies, and the less our economy depends on energy."[185] The *Globe and Mail* article noted that Huber was employed by the "conservative Manhattan Institute," but did not mention the annual oil industry funding it was receiving.

Like oil companies, governments also have an interest in controlling the conversation about oil supplies, and they also face a dilemma of needing to steer a difficult path between maintaining a rosy view of the present and future, while facing "hard truths" about oil depletion. Because of such worries, some governments maintain petroleum reserves or emergency stockpiles, and many in one way or another have conducted or commissioned studies projecting future oil supplies and exploring peak oil ideas and scenarios. In many ways, governments have signaled to their citizens that oil is at the center of everything. Governments have construed assured access to energy supplies as a foundation of economic and military power and social stability. Accepting this premise means,

181. Peter Huber and Mark T. Mills authored *The Bottomless Well: The Twilight of Fuel, the Virtue of Waste, and Why We Will Never Run Out of Energy* (New York: Basic Books, 2005), Kindle edition, locations 168, 173.
182. Ibid., location 327.
183. Ibid., location 403.
184. Ibid., location 153.
185. Barrie McKenna, "Welcome to the Age of Scarcity," *Globe and Mail*, 21 May 2005, B15.

however, that threats to energy supply must likewise be seen as posing great risks to the social order and to government authority, and indeed governments routinely discuss oil as a matter of national security. All of these concerns lead governments to pay close attention to peak oil. Yet at the same time, governments do not want concerns about oil supply either to cause panic, to change millions of people's consumption patterns and lifestyle choices too rapidly, or to lead to a profound questioning of government policies or national and global governance systems. The governments of capitalist states like Canada and the United States publicly espouse the idea that markets will meet consumers' demands, whether for mobile phones or auto fuel, and that, if demand grows, supply will increase to meet that demand. Peak oil theory implicitly challenges this view, however, so it is hardly surprising that many in government and business circles are reluctant to show strong support for this body of scientific theory. The result has been a kind of schizophrenia in which memes of assured abundance alternate with memes of threatened scarcity: both are regularly expressed within government, business, and finance circles. The mass media have echoed and diffused this schizophrenia. It is quite visible in the *Globe and Mail*'s coverage of the oil sector in general and peak oil in particular.

Oil price changes also cause trouble for governments, and this is a further reason why they seek to control the conversation about oil. If oil and gasoline prices rise too rapidly, governments have to deal with threats of recession, because oil prices affect every other sector of our energy-dependent economy. They also have to deal with angry consumers (who are also voters), many of whom believe that high oil prices mean that oil companies are gouging them, particularly because the companies receive "windfall profits" as a result of the price increases, at the very time that consumers suffer. In short, oil price spikes create tensions between oil producers and consumers that governments inevitably have trouble mediating. This is particularly true in Canada because the price rises simultaneously bring boom times to oil-rich provinces while crushing economic growth in oil-importing provinces. On the other hand, if oil prices drop too far and too quickly, governments immediately lose billions of dollars in revenue, also putting them at odds with voters and diminishing confidence in the government's handling of economic affairs. Dropping oil prices moreover create the threat that further investment in expensive oil resource development projects will be curtailed (which is often the case), which further harms government revenues and sets the stage for new price spikes down the road.

All of these oil-price dilemmas are profusely evident in the *Globe and Mail's* coverage of the oil sector, and indeed the newspaper often seemed to convey a sense of unhappiness whether oil prices rose or fell, although this expression of unhappiness was sometimes tempered by focusing on

the experience of "winning" provinces. A series of headlines on oil prices from 2001 to 2011 illustrate these points: "Oil drops sharply as outlook dims" (September 2001);[186] "Oil at $40 worsens the 'pain'" (May 2004);[187] "$50 oil: As record falls, 'It's great to be in Alberta'," (September 2004);[188] "$100 oil adds fuel to fears on economy" (2008 February);[189] "Economic woes grow as markets, oil drop" (July 2008);[190] "Skyrocketing oil prices put recovery at risk" (February 2011).[191] The rapid decline in oil prices from the summer of 2014 to the winter of 2015 has continued the pattern of unease.[192]

When the mass media frame issues and discourse strongly in particular ways—as with the case of peak oil theory—they are effectively engaging in propaganda, but they must also continually modulate that propaganda—following cues from government and business—to support the smooth functioning of global commodity and governance systems, and to shape people's behavior as consumers and citizens. The journalistic value of "balance" can be seen as a form of such modulation. By closely juxtaposing, for example, comments about the inevitability of oil depletion with equally strong comments touting the virtue of wasting energy and promising continued oil abundance, the *Globe and Mail* minimized the impact that either statement would have if it were expressed alone, thus helping to keep the system on an even keel. Similarly the growing number of columns in the *Globe and Mail* that attacked peak oil thinking dampened the impact of the growing number of book reviews and articles by non-journalists that promoted it. The result was not balance in any meaningful intellectual sense, however, but rather cognitive dissonance, which itself can be a tool to control behavior.

The disconnect between the way oil prices were discussed on the front pages and the business pages can also be seen as mechanism of feedback to modulate economic behavior. In this case, the media conveyed needed information about changes in global oil supplies to business-section readers (assumed to be knowledgeable professionals), while conveying very different oil price explanations to more casual, front-page browsers. The business-section explanations focused more on underlying structural causes of oil price changes, while the front-page articles focused on

186. Lily Nguyen, "Crude Prices Suffer Major Blow: Oil Drops Sharply as Outlook Dims," *Globe and Mail*, 25 September 2001, B1.
187. Patrick Brethour, "Oil at $40 Worsens the 'Pain'," *Globe and Mail*, 12 May 2004, A1.
188. Mahoney, Walton, and Brethour, "$50 Oil."
189. Ebner, "Highest Close Ever."
190. Kevin Carmichael, "Financial Outlook: Economic Woes Grow as Markets, Oil Drop," *Globe and Mail*, 16 July 2008, A1.
191. David Ebner, "Skyrocketing Oil Prices Put Recovery at Risk," *Globe and Mail*, 24 February 2011, A1.
192. E.g., Babad, "Oil's 'Hog Cycle' Smacks Canada."

uncontrollable short term, international political events, directing attention away from concerns about long-term supply and price trends. Large numbers of consumers have literally built their lives around availability of cheap energy, so major changes in this realm could produce considerable political fallout, depending on how these changes were understood. Someone who borrowed money in 2007 to purchase an SUV—convinced of future oil abundance—might not be very pleased to be informed that conventional crude oil production rates were stagnating globally since 2005, and that a community of researchers had been tracking and forecasting this situation for years. Front-page articles typically expressed solidarity with the plight of drivers hit by higher gas prices, promoting a sense of common suffering caused by an unexpected change. This approach depicted oil price changes as an unfortunate, almost random fact of life, like a flu outbreak. In addition, articles often modulated behavior by offering direct advice, as in the large headlines, "Cut energy use, Ottawa says,"[193] and "Nine reasons not to panic,"[194] or by giving consumers advance warning of higher gas prices, as in a May 2004 large-font text box: "Gasoline prices are not likely to peak for at least another month and are expected to remain elevated until September."[195] For people who might have been planning to spend their vacation driving in their RV's, the message was pretty clear. And hopefully they would not look beyond the message to notice its incongruence with the random, short-term causes offered to explain the price rises.

The Canadian Context

Canada has a rather unique position within the global oil production system, a conflicted relationship with the idea of peak oil, and these characteristics have shaped the *Globe and Mail*'s news coverage. Canada has one of the world's largest sources of unconventional oil, the Alberta oil sands (tar sands).[196] Already in the 1940s, this resource was reported in the *Globe and Mail* to be an enormous reserve that would be tapped once conventional oil production began to decline.[197] A 1949 article cited petroleum engineer E. M. Holbrook, who predicted that, as conventional oil fields became depleted around the world, "development of the

193. Steven Chase, "Cut Energy Use, Ottawa Says," *Globe and Mail*, 24 October 2002, A1.
194. Dave Ebner, "A Contrarian's Guide to Oil: Nine Reasons Not to Panic," *Globe and Mail*, 28 May 2005, B6.
195. Brethour, "Oil at $40 Worsens the 'Pain'."
196. Andrew Nikiforuk, "Saudi Alberta: No Place Like It," *Globe and Mail*, 1 July 2006, A16. For more background on the Athabasca tar sands, see also Nikiforuk's book, *Tar Sands: Dirty Oil and the Future of a Continent* (Vancouver: Greystone Books, 2008).
197. "Northern Oil Reserves Counted Upon as Huge," *Globe and Mail*, 17 March 1944, 19.

Athabaska tar sands" would "fill the need for many years to come" and Canada would "become one of the greatest oil producing nations of the world."[198] Fast-forward to the first decade of the 21st century and, just as conventional oil production was peaking globally, Canadian tar sands production began coming on-stream in a big way. It was in this context that, in July 2006, Stephen Harper, giving his first speech abroad as Prime Minister, announced that Canada was an "emerging energy superpower." The news was given top front-page billing in the *Globe and Mail*: "PM brands Canada energy superpower," and the article reported that Harper "bragged about Canada's vast and seemingly limitless energy resources."[199]

Harper could not have been referring in his speech to conventional oil production. Alberta's conventional (light) crude oil production peaked over three decades earlier, in 1973 and had declined over 90% by 2005, from around 1.3 million barrels a day at its peak to a little over 100,000 barrels a day.[200] Alberta's decline was offset by Atlantic Canada's offshore oil, but these new sources never brought national production back to the level of 1973. Moreover, the two largest offshore oil fields, Hibernia and Terra Nova, both peaked around 2003-2004.[201] And Canada's offshore oil production has declined overall since 2007, despite production from a new offshore field, White Rose, which began in 2005.[202]

Canada's 21st century "energy superpower" status was thus based on the oil sands resource, whose growing exploitation was driven by the global peaking of conventional oil. An article in the "Crude Awakening" series observed, "A decade ago, the oil sands were a fringe operation. Today, they are considered the key to North American oil security."[203] A key

198. "Athabaska Oil: Tar Sands May Supply All World," *Globe and Mail*, 17 October 1949, 21.

199. Jane Taber, "PM brands Canada energy superpower," *Globe and Mail*, 15 July 2006, A1. See also Laura Way, "An Energy Superpower or a Super Sales Pitch? Building the Case through an Examination of Canadian Newspapers Coverage of Oil Sands," *Canadian Political Science Review* 5, 1 (2011): 74-98.

200. Alberta Oil and Gas Industry, Quarterly Update, Winter 2013, 12. Available at: https://albertacanada.com/files/albertacanada/OilGas_QuarterlyUpdate_Winter2013.pdf, accessed 17 July 2014.

201. National Petroleum Council, Offshore Supply Subgroup of the Resource & Supply Task Group, "Offshore Oil and Gas Supply," *Working Document of the NPC North American Resource Development Study*, 15 September 2011, 20-23. Available at: https://www.npc.org/Prudent_Development-Topic_Papers/1-3_Offshore_Oil_and_Gas_Supply_Paper.pdf, accessed 17 April 2015.

202. Fisheries and Oceans Canada, *Economic Impact of Marine Related Activities in Canada*, especially Part III and Appendix A, available at: http://www.dfo-mpo.gc.ca/ea-ae/cat1/no1-1/no1-1-econonational-eng.htm, accessed 17 April 2015.

203. Eric Reguly, "Oil Sands Mother Lode Could Doom Gas Reserves," *Globe and Mail*, 28 May 2005, B2.

variable in this shift was the oil price rise that occurred as the world moved to the conventional oil production peak. Oil production from the tar sands has a low EROI (i.e., a low net energy output) compared to conventional oil, and it could be profitably produced on a large scale only as oil prices moved sharply higher in the first decade of the 21st century. Oil sands producers need a price per barrel of $60 or higher to break even, and some projects require an oil price above $100-$130 a barrel.[204] In a letter to the editor following publication of the *Globe and Mail*'s "Crude Awakening" series, EnCana's CEO told readers "Why the future will be unconventional." He included a fossil-fuel resource pyramid diagram, illustrating the world's shift from conventional oil and gas sources to larger but more costly unconventional fossil fuel resources. "While old conventional reserves are declining," he explained, "unconventional production is growing." Tapping resources like the oil sands required "large amounts of technical ingenuity, persistence, and capital. Their economic production requires . . . higher prices. . . . At EnCana, we have chosen to focus almost all of our future on unconventional gas and oil."[205] It would have been foolhardy for EnCana to put all its eggs in the unconventional basket, unless it was pretty certain that no vast new conventional oil and gas resources would be found, whose production would drive down oil and gas prices.

A further reason that Harper could begin to tout Canada as an energy superpower in 2006 is because the Canadian government began to count the oil sands as part of its "proved oil reserves," and it was able to convince important organizations outside Canada to do the same. Previously, the globally accepted definition of "proved oil reserves" pertained only to liquid oil that flowed from the ground. Yet the bitumen found in oil sands does not flow, and it must be manufactured into synthetic oil after being dug up and separated from the sand it is mixed with. In 1999, Alberta's Energy and Utilities Board (AEUB) made a determination that the Albertan oil sands contained the equivalent of 175 billion barrels of oil recoverable with current technology. Inclusion of this figure in its oil reserves statistics immediately raised Canada's proved reserves from under 10 billion barrels to 180 billion barrels of oil equivalent. The AEUB together with the Canadian Association of Petroleum Producers then lobbied the U.S.-based *Oil and Gas Journal* to include the new figure in its influential annual year-end review. More

204. Yadullah Hussain, "Cost-Cutting Fever Grips Oil Sands Players as Economics Called into Question," *Financial Post*, 22 August 2014, available at: http://business.financialpost.com/news/energy/fp-energy-aug-22-cost-cutting-fever?__lsa=023b-52d, accessed 17 April 2015. See also Nathan Vanderklippe, "Energy; Oil Sands 'Back in Black' as Crude Nears $70," *Globe and Mail*, 2 June 2009, B1.

205. Gwyn Morgan, "Why the Future Will Be Unconventional," *Globe and Mail*, 28 May 2005, B7.

importantly, in 2003, the U.S. energy secretary agreed to include the new figure in its official calculations of national oil reserves.[206] Finally, in 2004, the OECD's energy arm, the Paris-based International Energy Association followed suit, and began including the new Canadian estimate in its influential global oil reserves estimates.[207] In this way, Canada's oil reserves suddenly became the world's second largest after Saudi Arabia. Not only did this altered definition underwrite Canada's transition to the status of energy superpower, but "it also signaled that the world was not running out of oil."[208] In other words, inclusion of Canada's oil sands reserves in official international statistics helped to paper over the fact that worldwide conventional oil discoveries and production were stagnating.

Given that Canada's rise as an "oil power" was directly tied to rapidly rising oil prices in the face of stagnating or declining global conventional oil production, it is not surprising that Canadian officials wished to avoid discussion of peak oil. In contrast to other leading industrial countries like the United States, the United Kingdom, Australia, Germany, France, and Sweden, the Canadian government has sponsored no studies of peak oil, nor has the Canadian Parliament taken up the matter.[209] The only Canadian government-authorized study I have found that addressed peak oil included two short paragraphs on the subject buried within a broader study of "The Future Security Environment 2008-2030," written for the Canadian Armed Forces Chief of Force Development S.A. Beare in 2010.[210] The government of Alberta similarly remained mum on the subject. It submitted a statement for hearings on "the theory of peak oil" held in 2006 by a committee of the U.S. House of Representatives. But the statement avoided the subject of the hearings: "The Government of Alberta does not have an official opinion regarding the theory of 'Peak Oil'."[211]

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206. Erin Anderssen, Shawn McCarthy, and Eric Reguly, "Shifting Sands; How Alberta's Oil Boom Has Changed Canada Forever; Part I: An Empire from a Tub of Goo," *Globe and Mail*, 26 January 2008, F4-F5.

207. Preston Manning and Fred Kerr, "Alberta is Already Spreading the Wealth," *Globe and Mail*, 1 August 2006, A15.

208. Anderssen, McCarthy, and Reguly, "An Empire from a Tub of Goo," F5.

209. The lack of Canadian attention to peak oil is discussed in Rick Munroe, "What is Canada Doing About Peak Oil," available at: http://www.resilience.org/stories/2008-02-21/what-canada-doing-about-peak-oil, accessed 17 April 2015. According to this source, a search for "peak oil" on the website of Natural Resources Canada produces no hits pertaining to this topic, whereas the same search on the U.S. Department of Energy website produces more than 8,000 hits.

210. Canada, Minister of National Defence, *The Future Security Environment 2008-2030, Part I: Current and Emerging Trends* (2010), 44-45. Available at: http://publications.gc.ca/collections/collection_2011/dn-nd/D4-8-1-2010-eng.pdf, accessed 17 April 2015.

211. House of Representatives, 109th Congress, First Session, *Understanding the Peak Oil Theory: Hearing Before the Subcommittee on Energy and Air Quality of the Committee on*

Following the government's cue, most of the *Globe and Mail's* coverage of the oil sands has not linked the growth of oil sands production in the 21st century to peak oil—i.e. to stagnating conventional oil production that drove oil prices higher.[212] In a 2008, weeklong series of articles on the oil sands, the lead article surveyed the making of "an empire from a tub of goo."[213] Yet in this long, two-page article on the rise of the oil sands, the only statement about how this rise was connected to oil prices and conventional oil supplies was buried in a paragraph close to the end of the article, stated almost as an afterthought:

> In addition, the price of oil began to rise, removing much of the doubt that mining the sands could be profitable. *Striving to replace dwindling conventional reserves*, energy companies from China, France, Norway and Japan came hunting for a share of Alberta forest... [my italics][214]

The bulk of the article was structured around the ideas that the oil sands were a product of a long development effort, that they were important as a democratic alternative to oil reserves "in politically volatile regions controlled by undemocratic states,"[215] and that they became important when Alberta's energy minister managed to convince the world that they were "oil." In explaining how the development effort finally paid off, the article noted, "to expand profitably…the technology had to improve." What technology finally achieved this goal? Companies working in the oil sands were mainly engaged in massive strip mining operations—on a scale so vast as to be visible from outer space. The technology that allowed production "to expand profitably" was "enormous dump trucks." The question of why it took thirty years of development effort to recognize the need for large dump trucks was ignored, but in any event, the weakness of this technological argument only underscores the centrality of high oil prices and a dearth of easy-access conventional oil sources in the shift to oil sands production. Working with the oil sands was tremendously difficult and would hardly have attracted oil companies if they had adequate conventional oil supplies to tap. The *Globe and Mail* conveyed the challenge of oil sands production through an imagined experiment:

> Take molasses out of your kitchen cupboard, put as much sand in there as molasses, stir it up, and then put it outside where it gets cold and thick and won't

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Energy and Commerce, Serial No. 109-41, December 7, 2006, Statement of the Government of Alberta, 63 p.

212. An exception is Russell Gold, "Petroleum: As Prices Surge, Oil Giants Turn Sludge into Gold," *Globe and Mail*, 27 March 2006, B12. Another exception is Reguly, "Plateau Theory Drives Total to Oil Sands."

213. Anderssen, McCarthy, and Reguly, "An Empire from a Tub of Goo," F4-F5.

214. Ibid., F5.

215. Ibid., F4.

> flow well, that's what the tar sand is like. It's extremely hard to work with, and it wrecks all your equipment.[216]

Why would any oil company put up with this unforgiving substance, located moreover in a cold and remote region, if they could access easier reserves of liquid crude oil?

Instead of tracing the relationship between peak oil and the rise of oil sands production, *Globe and Mail* articles on the oil sands have emphasized an alternate set of ideas and themes. Some have emphasized the theme of technology producing energy abundance.[217] Some have accepted the new, consolidated definition of "oil" and even argued on that basis that rising oil sands production proves the incorrectness of peak oil theory.[218] Some, acknowledging that oil sands production required very high oil prices to expand, adopted the idea that "there is no shortage of oil; there is just a shortage of oil at low prices."[219] Others promoted the idea that Canadian oil sands production expanded because it was "in demand" because Canada was a peaceful, democratic country. An article with the headline "Kinder, gentler energy superpower" seemed to suggest that the U.S. favored tapping Canadian oil sands because it wanted to shift its business away from "unstable regions and OPEC countries."[220] This idea, which echoed notions put forward by Stephen Harper and other government officials, was disingenuous to say the least. American oil companies started producing oil in Iraq after the U.S. invasion and are still operating there, hardly a "stable region"; U.S. companies routinely source oil from undemocratic states or unstable regions in Africa, such as Nigeria and Equatorial Guinea; Saudi Arabia and other OPEC states are in fact close allies of the U.S.; and the U.S. has never stopped buying OPEC oil.

Within the *Globe and Mail*, if not within Canada as a whole, the story of the oil sands expansion tended to obscure the story of conventional oil's dimming prospects, particularly since the two coincided. The story of peak oil was likewise masked by acceptance of altered definitions of oil

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216. Ibid. The thought experiment was quoted from David Finch, *Pumped: Everyone's Guide to the Oil Patch* (Calgary: Fifth House, 2008). Oil is also produced from the tar sands by an in situ method that does not depend on strip mining.

217. Barrie McKenna, "Welcome to the Age of Scarcity," *Globe and Mail*, 21 May 2005, B15.

218. E.g., Neil Reynolds, "Oil and Gas: The World's Future Energy Kingdom: North America," *Globe and Mail*, 8 December 2010, B2.

219. Reguly, "Two Barrels of Oil Are Used for Each One Found, $100 Oil Anyone?" The argument that oil supply is just about price is misleading because it ignores the problem that arises when the energy cost of producing a barrel of oil equivalent becomes higher than the energy produced, or when the economic cost of environmental degradation becomes larger than the economic gain of tapping difficult, toxic, and low-EROI sources like the tar sands.

220. Brian McKenna and David Ebner, "The Texas Connection: The Kinder, Gentler Energy Superpower," *Globe and Mail*, 28 January 2008, A8.

reserves and oil production, driven by the oil sands lodestone. With respect to analysis of oil prices, the rise of the oil sands exacerbated the *Globe and Mail's* schizophrenic coverage of oil price changes. Journalists depicted rising oil prices as both beneficial and harmful. High oil prices meant booming oil sands production. Yet the effects of high oil prices in Canada pitted oil-producing provinces against oil-consuming provinces.[221] Jeff Rubin painted this situation as the "new 'two solitudes'" which fell "on either side of the energy divide."[222] On one side of the divide (notably in Alberta), high oil prices signaled prosperity, jobs, and GDP growth, while for those on the other side of the energy divide (notably in Ontario and Quebec), high oil prices meant job losses, plant closures, stagnating exports, and empty wallets.

Conclusion

U.S. Secretary of Defense Donald Rumsfeld famously offered a threefold categorization of the boundaries between knowledge and ignorance when he referred to the differences between "known knowns," "known unknowns," and "unknown unknowns."[223] This paper has argued that peak oil theory is a growing body of knowledge that, like climate change science and meteorology, seeks to transform "unknown knowns"—things we know that we don't know, such as the profile of global oil production over the next half century—into (hopefully) "known knowns," by means of estimates based on empirical data, theorization, and mathematical modeling. I have also argued that the *Globe and Mail* transformed peak oil theory into an "unknown unknown." It constructed ignorance of this subject, at least for unwary readers.

Like meteorology and climate change science, peak oil theory is so complex in its details that it must remain "unknown" in detail to most newspaper readers. But the *Globe and Mail* made it *doubly* unknown by conveying the impression that no bonafide oil depletion science even existed. On balance, peak oil theory was not represented in the *Globe and Mail* as a growing domain of scientific inquiry, its important results and methodologies since Hubbert were ignored or underreported, and its practitioners were often treated disparagingly. Explanations that were needed to make sense of peak oil theory, such as the divergent definitions of "oil," were not provided. And in the A-section of the newspaper,

221. Derek DeCloet, "Shifting Sands: How Alberts's Oil Boom Is Changing Canada Forever; Part Seven: Impact on Canada's Dollar and Overall Economy," *Globe and Mail*, 2 February 2008, B4; "Shifting Sands: Part Seven Cont'd," 2 February 2008, B5.

222. Jeff Rubin, "Book Excerpt: Canada's Two New Solitudes; We'll Be Divided by Oil," *Globe and Mail*, 6 October 2010, B6.

223. The comments were made at a 2002 Department of Defense news briefing, archived at: http://www.defense.gov/transcripts/transcript.aspx?transcriptid=2636, accessed 19 February 2015.

changing oil prices were disassociated from underlying supply issues. The *Globe and Mail* led readers away from wondering if future oil supply and peak oil theory were "unknowns" they should learn more about.

Two aspects of the shape of this constructed ignorance are particularly troubling. One was the implicit negation of the "known known" of oil depletion. This was done partly in the manner of advertising: continually repeating the message to make it stick. The message in this case was a promise of eternal abundance—wasting oil would produce more oil; demand for oil would always produce supply; peak oil theory was obsolete; oil production would never peak; it would reach a plateau that would continue forever; finding oil was simply a question of money; technology would always find a way to pull more oil from the ground and the oceans. Second, and equally troubling, was the altered view of science that came from facile rejection of a discomforting theory. Scientific research depends on sustained, careful development of arguments backed by supporting evidence and, increasingly, by mathematical modeling of the phenomena under study. Rejections of scientific findings are likewise supposed to be based on arguments backed by supporting evidence. However, the *Globe and Mail's* rejection of peak oil theory was based mainly on emotion and political ideology. The *Globe and Mail* propagated the idea that peak oil theory was a "fashion" that temporarily became "all the rage"[224] because of high oil prices, and it speculated, "governments and the broader public may lose interest in the theory if prices settle back into a more comfortable range."[225] This was a consumer's view of knowledge. Such a view was likewise embodied in the *Globe and Mail's* focus on peak oil as a controversy that required equal coverage pro and con. Ideas consistent with peak oil theory were set against equal and opposite ideas. Readers were left to decide which they preferred. Such a notion promoted a "free to choose" mindset, where knowledge shoppers loaded up their carts with their favored theories and forgot the rest. In the case of peak oil, unlike climate change science, pessimistic implications were projected as a valid reason to toss the theory out of the cart.

Scholars have added a fourth category to Rumsfeld's original typology: the category of "unknown knowns," which are taken to mean things that are known (or knowable) but are suppressed or repressed.[226] The evidence presented throughout this paper shows that the *Globe and Mail's* coverage of peak oil also encompassed this fourth category. There has been some deliberate cultivation of ignorance by both the oil industry and other

224. Barrie McKenna, "Those Quick to Deride Peak Oil Theory Also Don't Know Jack," *Globe and Mail*, 19 September 2006, B8.

225. Shawn McCarthy, "Oil and Gas: As Prices Tumble, Doomsayers Hold Fast to Prophecy," *Globe and Mail*, 16 September 2006, B5.

226. See, e.g. Rayner, "Uncomfortable Knowledge." Rayner argues that tacit knowledge also constitutes a form of "unknown known."

institutional actors, some of which has been transmitted through the pages of the *Globe and Mail*. Let us not forget the discrepancy between, on one side, ExxonMobil's anti-peak oil advertisements and funding of anti-peak oil think tanks, and on the other side, the acknowledgement by retired ExxonMobil CEO Lee Raymond of the need to face the "hard truths about energy," notably that "world oil and gas supplies from conventional sources are unlikely to keep up with rising global demand over the next 25 years." Nor should we overlook the cultivation of ignorance by Chief Economist Fatih Birol of the IEA, which was transmitted in the *Globe and Mail*. As noted earlier, he professed acceptance of peak oil theory in 2011 but only a few years prior the *Globe and Mail* had cited his quip that peak oil was just "a fashion."[227] In between those dates, the IEA had come under fire from peak oil researchers—the "Uppsala critique"—for presenting over-optimistic scenarios that were incompatible with available empirical data.[228] At roughly the same time, IEA whistleblowers, including a senior official, claimed that the US had pressured the IEA "to underplay the rate of decline from existing oil fields while overplaying the chances of finding new reserves" and that this was done to guard against "panic buying."[229]

There are other "unknown knowns" at stake in the *Globe and Mail's* construction of peak oil ignorance as well. The question is, what do we hide from ourselves by not seeing peak oil theory as a legitimate body of scientific knowledge about oil depletion? First, we hide the need to pay attention to the mountain of evidence tracking our path toward depletion.[230] We also hide the need to think more assiduously about the

227. Brethour, "Only Conservation Efforts Will Keep a Lid on Energy Costs."

228. The Uppsala critique was later published in a refereed journal: Kjell Aleklett et al, "The Peak of the Oil Age–Analyzing the World Oil Production Reference Scenario in *World Energy Outlook 2008*," *Energy Policy* 38, 3 (2010): 1398-1414. Richard G. Miller analyzed the whistleblowing episode and critique in a submission to the Chief Scientific Advisor at the U.K. Department of Energy and Climate Change, David Mackay. See Richard G. Miller (for the Oil Depletion Analysis Centre), "Future Oil Supply: the Changing Stance of the International Energy Agency," 30 August 2010, available at: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/43203/1793-odacs-response-call-for-evidence-oil.pdf, accessed 18 February 2015.

229. Terry Macalister, "Key Oil Figures were Distorted by US Pressure, Says Whistleblower," *The Guardian*, 9 November 2009, at: http://www.theguardian.com/environment/2009/nov/09/peak-oil-international-energy-agency, accessed 17 April 2015. These claims were reported a few days later in the *Globe and Mail*. See Eric Reguly, "Awash in Oil? Not If You Ask the Folks Who Pump It," *Globe and Mail*, 12 November 2009, B2.

230. Interestingly, over the four decades from 1970 to 2010, the words "oil" and "depletion" have been used together less and less frequently in *Globe and Mail* articles: 442 times in the 1970s, 287 times in the 1980s, 96 times in the 1990s, and 82 times from 2000 through 2009. There is, in one respect, a simple explanation for this trend: the ending of the oil depletion allowance. Nevertheless, the fact remains that oil depletion was a common term in the *Globe and Mail* as long as companies got a tax break from it, but has

structures of our society's reliance upon fossil fuels and about the transitions that must someday occur. Our reliance has shaped our food system, our production system, our patterns of consumption, mobility, warfare, entertainment, home and family life, the structure and layout of our cities, and myriad other systems and institutions, not to mention our view of what constitutes a civilized way of life. How and when should these be reorganized to depend less on fossil fuels? At what pace must change occur, and how will economies be affected? Is this a transition that market forces can easily accommodate? How can we insure that change will proceed equitably, without undue social tension or political upheaval? And how can we insure, for example, that private oil companies will continue to offer the products so many of us depend on, and will not unexpectedly go bankrupt and leave clients in the lurch, as has happened so often with so many other companies?

Finally, within the Canadian context, we hide from ourselves the profound interconnections between our way of life, oil depletion, exploitation of the oil sands, and the problem of climate change. By neglecting to emphasize the concept of EROI, for example, and by newly including oil sands production within the category of "oil," the much higher levels of carbon emissions and energy required to produce synthetic oil from solid bitumen are obscured.[231] The paradox is that the *Globe and Mail* reports at length on the dangers of climate change, but as soon as it is a question of oil production, the meme shifts to the denial of peak oil and to the promise of eternal expansion and abundance: more oil for everyone in the future, more jobs in the oil patch, more economic growth for Canada, a new superpower status. Underneath, however, we know not only that our use of fossil fuels is the driver of our climate problem, but also that it is the one variable in the climate change equation that we have the greatest ability to alter.

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increasingly fallen from use as we have begun to experience its consequences on a global scale. (The search, using Proquest, was defined to include articles, editorials, letters to the editor, and reviews.)

231. Making a barrel of oil from the tar sands produces three to four times more carbon emissions than pumping a barrel of conventional crude oil, and the progress that Ontario and Quebec have made toward reduction of carbon emissions does not begin to offset the rapid growth of carbon emissions from the expansion of oil sands production. See the Pembina Institute fact sheet at: http://www.pembina.org/oil-sands/os101/climate, accessed 17 April 2015; and Canadian government data, notably for "Greenhouse Gas Emissions by Economic Sector" and "Greenhouse Gas Emissions by Province and Territory" at: www.ec.gc.ca/indicateurs-indicators/default.asp?lang=En&n=03603FB3-1, accessed 17 April 2015. See also Bengt Söderbergh, "Canada's Oil Sands Resources and Its Future Impact on Global Oil Supply," *Uppsala Hydrocarbon Depletion Study Group,* Uppsala University, Sweden (2005).