GLOBAL GAS MARKETS: THE ROLE OF LNG IN THE GOLDEN AGE OF GAS AND THE GLOBALIZATION OF LNG TRADE

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I. INTRODUCTION

As the world enters the second decade of the 21st century, policy makers around the globe continue to grapple with issues related to energy security, energy affordability, and an expected increase in demand for all energy sources. At the same time, concerns about global climate change and reducing greenhouse gas emissions remain in focus as the world struggles to define the path to a sustainable energy future.[1] As an abundant, affordable, and clean-burning fuel, many countries around the world are increasingly looking towards natural gas to play a key role in powering the future.[2] The prospects for natural gas are so promising that the International Energy Agency (IEA) has suggested that the 21st century could be the "Golden Age of Gas" with demand for natural gas projected to increase by more than fifty percent from the 2010 levels and "account for over [twenty-five percent] of world energy demand in 2035."[3]

Along with the increased demand for natural gas comes a

1. *See* INT'L ENERGY AGENCY [IEA], WORLD ENERGY OUTLOOK 2011: ARE WE ENTERING A GOLDEN AGE OF GAS? 7, 85 (2011) [hereinafter IEA WEO-2011], *available at* http://www.worldenergyoutlook.org/media/weowebsite/2011/WEO2011GoldenAgeofGasReport.pdf.

2. *Id.* at 7.

3. *Id.* at 9.

corresponding increase in international trade in natural gas, with most of the increased trade expected to be in the form of liquefied natural gas (LNG).[4] LNG is natural gas that has been cooled to approximately -161°C, at which point it condenses to a liquid that can then be shipped via LNG tanker anywhere in the world.[5] Since many natural gas reserves are located away from key demand markets, LNG offers an important solution for the global gas markets in terms of moving natural gas to markets where it is most needed.[6]

Through the lens of the IEA's *Golden Age of Gas Report*, this Article explores the growing role of LNG as the "glue" linking global gas markets and identifies a number of developments in global gas markets giving rise to new opportunities and challenges for LNG in the coming decades.[7]

Part II of this Article discusses the increasingly important role of natural gas in the global energy mix. This includes a discussion of the divergent views of natural gas as the world struggles to meet growing energy demand in the coming decades with cleaner burning fuels.

Part III addresses the role of natural gas through the lens of the IEA's Special Report, *The Golden Age of Gas*. Will the 21st century be the Golden Age of Gas? What are the key drivers behind the expected increase in natural gas in the global energy mix?

Part IV addresses the role of LNG in the Golden Age of Gas and highlights the important role LNG plays in global gas markets. In recent years, the significant increase in interregional LNG trade has led many to question whether the gas markets are globalizing, and whether LNG can someday trade as a global commodity.[8] The general consensus that seems

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4. IEA, WORLD ENERGY OUTLOOK 2010 192 (2010) [hereinafter IEA WEO-2010], *available at* http:// www.worldenergyoutlook.org/media/weo2010.pdf.

5. *See LNG: A Liquid Market*, ECONOMIST (Special Report), July 14, 2012, at 15–17.

6. *Id.* at 9–10.

7. IEA, MEDIUM-TERM OIL & GAS MARKETS 2010, 158 (2010) [hereinafter MEDIUM-TERM OIL & GAS MARKETS 2010], *available at* http://www.iea.org/publications/ freepublications/publication/mtogm2010-1.pdf.

8. *Id.*

to have emerged is that while LNG markets are globalizing in terms of the increase in trade and the number of countries involved, LNG is still not likely to become a global commodity anytime soon for lack of a single pricing structure.[9] Nonetheless, there is widespread recognition that LNG is the "glue" linking global gas markets and indeed, the Golden Age of Gas would not be possible without LNG.[10]

Part IV also addresses the traditional oil-linked pricing structure for LNG and discusses recent pricing developments in global LNG markets indicating that the traditional market structure for LNG trade is likely to continue to evolve into a more dynamic and flexible model that better reflects the LNG trade of today.

While the pace and scale of the global economic recovery remains uncertain as this Article goes to print, with energy policies in a state of flux in most regions around the world,[11] this Article takes the long-term view that over time, demand for natural gas will continue to increase as more countries look to meet the rising demand for energy with lower emission fuels.[12] Accordingly, the Article concludes that the future looks bright for LNG to play an increasingly important role in the world's energy future.

II. THE ROLE OF NATURAL GAS IN THE 21ST CENTURY

As the world entered the 21st century, there were a number of challenges confronting policy makers around the globe in terms of energy security, energy poverty, climate change, and an increased focus on reducing greenhouse gas emissions. As a clean-burning fuel, many business and policy leaders began to look to natural gas and LNG to meet growing energy demand.[13] During the first decade of the 21st century, natural gas demand

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9. *See An Unconventional Bonanza*, ECONOMIST (Special Report), July 14, 2012, at S.5–.7.

10. MEDIUM-TERM OIL & GAS MARKETS 2010, *supra* note 7, at 158.

11. IEA WEO-2010, *supra* note 4, at 45.

12. IEA WEO-2011, *supra* note 1, at 7, 85.

13. *See* John Podesta & Timothy E. Wirth, *Natural Gas: A Bridge Fuel for the 21st Century*, CENTER FOR AM. PROGRESS (Aug. 10, 2009), http://www.americanprogress.org/issues/green/report/2009/08/10/6513/natural-gas-a-bridge-fuel-for-the-21st-century.

increased significantly, as did LNG's share in worldwide natural gas trade.[14]

However, in the global market place, natural gas received mixed reviews, especially as concerns about global climate change grew in the mid-2000s.[15] Some environmental groups viewed natural gas as yet another fossil fuel with its own set of environmental and emissions considerations.[16] Other groups and policy makers took the view that natural gas could be a "bridge fuel" to a renewable energy future.[17] Not surprisingly, the energy industry has embraced natural gas not as a "bridge" or transition fuel, but as a foundation or primary fuel for the 21st century.[18]

During the first decade of the 21st century, these divergent views tended to influence whether natural gas and LNG were perceived as fuels for the future.[19] As new technologies are developed and new opportunities for natural gas and LNG are sought by governments and the industry, these debates are likely to continue throughout the 21st century. Despite the often

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14. *See LNG: A Liquid Market*, *supra* note 5, at 15–17 (noting that LNG trade has not only been growing but that LNG demand "has doubled over the past decade").

15. SUSAN L. SAKMAR, THE GLOBALIZATION AND ENVIRONMENTAL SUSTAINABILITY OF LNG: IS LNG A FUEL FOR THE 21ST CENTURY? 1 (2010), *available at* http://www.worldenergy.org/documents/congresspapers/120.pdf (noting that while some viewed LNG as a means of meeting energy demands and environmental concerns, others viewed LNG as just another pollutant); Fiona Harvey, *Natural Gas is no Climate Change 'Panacea', Warns IEA*, GUARDIAN, Jun. 6, 2011, http://www.guardian.co.uk/environment/2011/jun/06/natural-gas-climate-change-no-panacea (citing IEA statement that natural gas is not the "panacea" to solve climate change that fossil fuel industry lobbyists have been claiming).

16. *See* Phil Radford, *"Natural" Gas Fails the Sniff Test*, GREENPEACE (June 27, 2011, 3:57 PM), http://www.greenpeace.org/usa/en/news-and-blogs/campaign-blog/natural-gas-fails-the-sniff-test/blog/35470Document3.

17. Podesta & Wirth, *supra* note 13.

18. AM. GAS ASS'N, 2013 POLICY HANDBOOK (2013), *available at* http://playbook.aga.org. The American Gas Association (AGA) refers to natural gas as "America's foundation fuel." According to the AGA, "Natural gas is clean, domestic, abundant and efficient, making it the perfect foundation fuel to help strengthen America's economic recovery, meet our environmental challenges and improve our overall national security by reducing our dependence on foreign energy sources." *Id.*

19. *Compare* Podesta & Wirth, *supra* note 13 (viewing natural gas as a "bridge fuel"), *with* Radford, *supra* note 16 (questioning whether natural gas is an environmentally friendly fuel source).

divergent views about natural gas and LNG, as the world enters the second decade of the 21st century, natural gas and LNG seem poised to assume a far greater role in the energy supply mix for many reasons that will be discussed throughout this Article.[20]

A. The Divergent Views About Natural Gas

As the world entered the 21st century, the role of natural gas in the energy supply mix was anything but clear. As concerns about climate change grew in the early to mid-2000s, there were a number of competing views regarding the role of natural gas coming from the industry, environmentalists, and a large group in the middle.

1. The Industry View—The Many Benefits of Natural Gas

Not surprisingly, the worldwide energy industry has embraced natural gas as a foundation fuel for the 21st century.[21] In support of their view, the natural gas industry has focused on the many benefits of natural gas and has set forth a coordinated view that highlights natural gas as a clean, affordable, reliable, efficient, and abundant source of energy.[22]

Natural Gas is Clean: Natural gas produces fewer emissions than any other fossil fuel and the most advanced combined cycle gas turbine (CCGT) power plants emit almost fifty percent less CO_2 than coal-fired power plants.[23]

Natural Gas is Affordable: Natural gas power plants have half the capital cost of coal plants, one-third the cost of nuclear plants, and one-fifth the cost of onshore wind.[24] Additionally, natural gas does not require subsidies, unlike most renewable technologies.[25]

Natural Gas is Reliable: In contrast to renewable technologies that in some cases may take decades of research,

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20. *See* IEA WEO-2011, *supra* note 1, at 7.
21. AM. GAS ASS'N, *supra* note 18.
22. INT'L GAS UNION, ADVOCACY MESSAGES FOR THE NATURAL GAS SECTOR (2010).
23. *Id.*
24. *Id.*
25. *Id.*

natural gas is readily available now from a variety of sources.[26] Natural gas is also a reliable back-up power source for intermittent energy sources such as wind and solar, which could facilitate the phase-in of renewables.[27]

Natural Gas is Efficient: Modern gas-fired power plants are forty percent more efficient than coal-fired power plants and require less construction time than coal or nuclear power plants.[28]

Natural Gas is Abundant: Global production of natural gas is expected to increase in the coming decade with growing supplies coming from both conventional and unconventional resources.[29] As will be discussed in Part IV, the significant increase in reserves and production of shale gas in recent years has led many to call shale gas an "energy game changer."[30]

2. From Big Oil to Big Gas?

In addition to more focused efforts to highlight the benefits of natural gas to the public, many of the world's largest international oil companies (IOCs) are increasingly focusing their core businesses on natural gas.[31]

For example, with its $40 billion acquisition of XTO Energy, Inc., ExxonMobil became the world's largest natural gas company in terms of reserves.[32] While Exxon has defended its move into natural gas, some industry experts have opined that the rush to natural gas is driven largely by declining oil reserves and a shrinking access to oil fields around the world due to

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26. *Id.*

27. *Id.*

28. *Id.*

29. *Id.*

30. Susan L. Sakmar, *The Global Shale Gas Initiative: Will the United States be the Role Model for the Development of Shale Gas Around the World?*, 33 HOUS. J. INT'L L. 369, 380 (2010–2011); *see also* Tom Fowler, *Energy Game-Changer?*, HOUS. CHRON., Nov. 2, 2009, at A1.

31. *Beyond the Black Stuff*, ECONOMIST, Feb. 4, 2010, http://www.economist.com/node/15473681.

32. *See* ERNST & YOUNG, US E&P BENCHMARK STUDY 7 (2012), *available at* http://www.ey.com/Publication/vwLUAssets/US_E_and_P_benchmark_study__June_2012/$FILE/US_EP_benchmark_study_2012.pdf.

geopolitical reasons.[33]

Royal Dutch Shell PLC (Shell) is also betting big on natural gas with plans to make gas roughly half of its total production by 2012.[34] Shell also believes that "natural gas, and LNG especially, will play critical roles in meeting global energy demand to 2050 during which time the world must reduce greenhouse-gas emissions by half."[35]

In February 2009, Woodside Petroleum, a leading Australian oil and gas company, unveiled a new corporate logo designed to place a greater emphasis on the future of its liquefied natural gas business.[36] It was just the third version of Woodside's logo in the fifty-five year history of the company, and the first substantial change in thirty-two years.[37]

According to the company, the changed logo, comprised of three ellipses coming together to form a "W," symbolizing a flame, better acknowledges Woodside's emergence as a global leader in LNG and the expectation that natural gas will dominate Woodside's production portfolio going forward.[38]

The role of natural gas as an accessible, relatively inexpensive, environmentally friendly, and widespread natural source of energy was outlined in a report issued in December

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33. Russell Gold & Angel Gonzalez, *Exxon Struggles To Find New Oil*, WALL ST. J., Feb. 16, 2011, http://online.wsj.com/article/SB10001424052748704409004576146362117313094.html.

34. Nick Snow, *Half of Shell's Production Will be Gas by 2012, CEO says*, OIL & GAS J. (Oct. 9, 2009), http://www.ogj.com/articles/2009/10/half-of-shell-s-production.html.

35. Warren R. True, *Gastech: Shell Sees Critical Roles for Gas, LNG*, OIL & GAS J. (Mar. 22, 2011), http://www.ogj.com/articles/201 1/03/gastech--shell-sees.html. *See generally* Malcolm Brinded, Exec. Dir. of Upstream Int'l, Royal Dutch Shell PLC, You Can Count on Gas (Mar. 21, 2011) (transcript available at http://www.shell.com/global/aboutshell/media/speeches-and-webcasts/2011/brinded-amsterdam-21032011.html#) (describing the importance of natural gas and LNG in a speech given at the Gastech Conference and Exhibition in Amsterdam).

36. *Woodside Logo a Gas*, OILONLINE (Apr. 20, 2009, 7:56 AM), http://www.oilonline.com/default.asp?id=259&nid=34338&name=Woodside+logo+a+gas; *see also* WOODSIDE, http://www.woodside.com.au/investors-media/resources/pages/our-logo.aspx (last visited June 25, 2013).

37. *Woodside Logo a Gas*, *supra* note 36.

38. Media Release, Woodside Energy, Ltd., New Look for Woodside (Feb. 4, 2009), *available at* http://www.woodside.com.au/Investors-Media/Announcements/Documents/04.02.2009%20Media%20Release%20-%20New%20look%20for%20Woodside.pdf.

2010 by the European Gas Advocacy Forum.[39] The Gas Advocacy Forum is an informal group of players from the European gas industry and includes Centrica, Eni, E. ON Ruhrgas, Gazprom Export, GDF SUEZ, Qatar Petroleum, Shell and Statoil.[40]

According to the report, Europe can reach its climate targets of reducing CO_2 emissions by eighty percent (compared to 1990 levels) by 2050, in a faster and more cost-efficient way if natural gas plays a significant part in the energy mix going forward.[41] If Europe were to switch from coal to gas now, the reduction target could be met at a savings of 400–450 billion euros, if one compares it to the European Climate Foundation roadmap launched earlier this year.[42] Additional cost savings for the 2030–2050 period would most likely also be achieved because natural gas in power generation requires lower investments.[43]

The universal support for natural gas by major energy companies is significant since any transformation in the energy sector is almost impossible without their support. This is primarily because most energy companies, whether multinational or national (e.g., controlled by the State), are vertically integrated.[44] They actively participate along the entire supply chain from locating the natural reserves, drilling and extracting the reserves, transporting the products around the world, and then refining and distributing the final products to end users.[45]

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39. Statoil, *European Gas Advocacy Forum Says Gas is Key for Europe*, EUR. ENERGY REV. (Dec. 13, 2010), http://www.europeanenergy review.eu/site/pagina.php?id=2608.

40. *Id.*

41. *Id.*

42. *Id.*

43. *Id.*

44. *See Idea: Vertical Integration*, ECONOMIST, Mar. 30, 2009, http://www.economist.com/node/13396061 (describing vertical integration and the fact that some of "the best known examples of vertical integration have been in the oil industry" where major energy companies tend to control every step involved, from production to distribution to end user).

45. *See id.*

3. Natural Gas is Still a Fossil Fuel

In a world concerned with climate change and greenhouse gas emissions, some critics of natural gas have taken the view that natural gas is yet another fossil fuel that should *not* play a major role in the world's future energy mix. For example, the Sierra Club recently announced that it is launching a new "Beyond Gas" campaign that represents a significant expansion of the group's ongoing efforts against other major fossil fuels and is modeled after the decade-old "Beyond Coal" campaign that sought to phase out coal-fired power plants.[46] According to the Sierra Club, it will seek to "prevent new gas plants from being built wherever we can."[47]

In general, critics of natural gas argue that increasing dependence on yet another fossil fuel does not move the world towards a real renewable energy future.[48] These critics point out that natural gas is still a fossil fuel that has some of the same negatives as coal and oil.[49] For example, unlike renewables, natural gas is a fossil fuel resource that we may eventually exhaust.[50] These same critics point out that the recent increase in unconventional shale gas drilling would not be occurring, but for the fact that the U.S. has already exhausted its conventional gas resources.[51] Shale gas drilling comes with its own environmental risks, including potential water contamination and increased greenhouse gas emissions.[52] In addition, while burning natural gas releases less CO_2 than coal, there are still

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46. Amy Harder, *War Over Natural Gas About to Escalate*, NAT'L J. (May 3, 2012), http://www.nationaljournal.com/energy-report/war-over-natural-gas-about-to-escalate-20120503.

47. *Id.*

48. Michael Levi, *Critics of Gas Should be Realistic*, FIN. TIMES, Nov. 28, 2012, http://www.ft.com/intl/cms/s/0/d1bc8bb0-3887-11e2-bd7d-00144feabdc0.html#axzz2JHibrfNI.

49. *Id.*

50. *Id.*

51. Chris Nelder, *Everything You Know About Shale Gas is Wrong*, SMART PLANET (Feb. 8, 2012, 5:00 AM), http://www.smartplanet.com/bl og/energy-futurist/everything-you-know-about-shale-gas-is-wrong/341?tag=search-river.

52. U.S. GOV'T ACCOUNTABILITY OFFICE, GAO-12-732, OIL AND GAS: INFORMATION ON SHALE RESOURCES, DEVELOPMENT, AND ENVIRONMENTAL AND PUBLIC HEALTH RISKS 2 (2012).

methane emissions to consider.[53]

The main fear natural gas critics seem to have is that the potential dependence on another fossil fuel, even though cleaner burning, could "doom" the world to "another few decades of fossil fuel reliance" at the sake of making inroads in clean energy deployment.[54]

4. *Natural Gas is a "Bridge" Fuel*

Some prominent groups have taken the view that at the very least, natural gas could be a "bridge fuel" to a renewable energy future.[55] This view acknowledges that the abundance of natural gas, particularly U.S. shale gas, creates an opportunity to utilize more natural gas to displace coal or oil, thereby significantly reducing CO_2 emissions.[56] Thus, so long as appropriate low-carbon policies are in place, such as a cap-and-trade system or a carbon tax, natural gas can play an important role as a bridge fuel to a renewable energy future.[57]

In the absence of low-carbon policies, however, there is a risk that reliance on natural gas will increase overall energy consumption and displace nuclear or other renewable energy sources for power generation, which would ultimately increase CO_2 emissions.[58]

Other prominent groups have focused their attention on the potential for natural gas to displace coal for power generation citing significant power plant emissions that would result.[59] In 2010, researchers at the Massachusetts Institutes of Technology (MIT) released the results of a two-year study that analyzed the

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53. Radford, *supra* note 16.

54. Brian Merchant, *Incoming: A Glut of "Natural Gas is Green" Nonsense*, TREEHUGGER (June 9, 2011), http://www.treehugger.com/fil es/2011/06/incoming-glut-natural-gas-green-nonsense.php.

55. Podesta & Wirth, *supra* note 13.

56. *Id.*

57. Stephen P.A. Brown, Alan J. Krupnick & Margaret A. Walls, *Natural Gas: A Bridge to a Low-Carbon Future?*, RES. FOR THE FUTURE 5 (Dec. 2009), *available at* http://www.rff.org/RFF/Documents/RFF-IB-09-11.pdf.

58. *Id.*

59. *The Future of Natural Gas*, MIT ENERGY INITIATIVE iii (June 6, 2011), http://mitei.mit.edu/system/files/NaturalGas_Report.pdf.

increased use of natural gas in the U.S. as a short-term substitute for replacing aging coal-fired power plants.[60] The report, titled "The Future of Natural Gas," acknowledged that U.S. energy and climate policy was in a state of flux and cautioned that while natural gas is often touted as a "bridge" to the future, a continuing effort is needed to ensure that the bridge has a landing point, such as the expansion of nuclear power or coal power generation using carbon capture technology (CCS) to reduce emissions in the long-term.[61] Thus, while the report found that natural gas is less carbon intensive than coal or oil, at the reduction levels required by 2050, the emissions from natural gas start to represent an emissions problem.[62]

B. The Global Economic Crisis and Projections for Natural Gas Leading into COP 15

In the midst of the debate over the role of natural gas in the future energy supply mix, the global economic crisis hit, and between 2008 and 2009, demand for all forms of energy dropped.[63] Demand for natural gas in particular plummeted.[64] However, at the same time, an enormous expansion of gas supply was underway in terms of unconventional or shale gas and LNG.[65]

Also in flux was the outcome of climate change negotiations and commitments and their potential impact on world energy markets.[66] All of these issues created unprecedented uncertainty in the world energy market in the late 2000s.[67]

In its *World Energy Outlook 2009*, the IEA noted that the challenges at the time were "urgent and daunting," and how governments rise to the challenge will have "far-reaching

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60. *Id.*

61. *Id.* at 16.

62. *Id.* at 57.

63. IEA WEO-2010, *supra* note 4, at 45; IEA, WORLD ENERGY OUTLOOK 2009 41 (2009) [hereinafter IEA WEO-2009], *available at* http://www.worldenergyoutlook.org/media/weo2010.pdf.

64. IEA WEO-2010, *supra* note 4, at 49.

65. *Id.* at 50.

66. *See* IEA WEO-2009, *supra* note 63, at 52–53.

67. *Id.* at 41.

consequences for energy markets."[68] In particular, the IEA noted the then-upcoming climate change talks (COP15) to be held in Copenhagen, Denmark, on December 7–18, 2009, at which leaders would negotiate a successor treaty to the Kyoto Protocol.[69]

In terms of demand for natural gas, the IEA noted that under any scenario, worldwide demand for natural gas was projected to grow after 2010, in light of constraints on low-carbon technologies.[70] However, the pace of that demand growth "hinges critically on the strength of climate policy action."[71] Over the long term, the IEA projected that more stringent policy action might favor efficiency and low-carbon technologies, thereby reducing natural gas demand.[72]

As the world became mired in economic problems towards the end of 2009, it became increasingly unlikely that world leaders would reach agreement on a successor treaty to Kyoto at COP15.[73] Ultimately, just prior to the COP15 conference in Denmark, it was announced that "President Obama and other world leaders have decided to put off the difficult task of reaching a climate change agreement . . . agreeing instead to make it the mission of the Copenhagen conference to reach a less specific 'politically binding' agreement that would punt the most difficult issues into the future."[74]

The result of COP15 was a political accord known as the Copenhagen Accord,[75] that was negotiated by only a subset of

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68. *Id.*

69. *See id.*

70. *Id.* at 48.

71. *Id.*

72. *See id.* (noting, in a discussion of the influence of policy action on the rate of change, that measures taken as part of such policy action might include encouragement by some regions of low-carbon technologies).

73. *See COP-15: Frequently Asked Questions*, EMBASSY OF THE U. S., SEOUL KOREA (DEC. 8, 2009), http://seoul.usembassy.gov/p_envi_120809.html (noting "[m]any political leaders have stated that COP-15 is unlikely to result in a permanent agreement to replace Kyoto.").

74. Helene Cooper, *Leaders Will Delay Deal on Climate Change*, N.Y. TIMES, Nov. 15, 2009, at A6.

75. *COP 15*, UNFCCC.INT, http://unfccc.int/meetings/copenhagen_dec_2009/session/6262/php/view/documents.php (last visited June 25, 2013).

the parties, including the United States and China.[76] This was not negotiated within the United Nations Framework Convention on Climate Change (UNFCCC) process, it was only noted by the COP, which left unclear which governments supported the Accord and its legal and operational significance.[77]

Needless to say, leading into 2010, global energy markets were in a state of flux, with energy and climate change policy uncertain in most countries.[78]

C. Natural Gas Grows in Importance - IEA WEO-2010 New Policies Scenario

By early 2010, the world appeared to be emerging from the worst of the economic crisis and demand for energy resumed its pre-recession upward trajectory.[79] Also starting in 2010 was the growing recognition that regardless of the divergent views about natural gas, natural gas would play a greater role in the world's future energy mix for a variety of reasons including demand growth, environmental benefits over other fossil fuels, and energy security.[80] Another reason for the growing importance of

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76. *See* John Vidal, Allegra Stratton, & Suzanne Goldberg, *Low Targets, Goals Dropped: Copenhagen Ends in Failure*, GUARDIAN (Fri. Dec. 18, 2009, 7:47 PM), http://www.guardian.co.uk/environment/2009/dec/18/copenhagen-deal (noting the Copenhagen agreement was brokered between China, South Africa, India, Brazil and the United States).

77. Jacob Werksman, *"Associating" with the Copenhagen Accord: What Does It Mean?*, WORLD RES. INST. (Mar. 25, 2010), http://www.wri.org/stories/2010/03/associating-copenhagen-accord-what-does-it-mean. There is a wealth of information and publications about climate change conferences, and a detailed discussion is beyond the scope of this Article. Information on the UNFCCC and the status of climate change discussions can be found at http://unfccc.int/2860.php.

78. IEA WEO-2010, *supra* note 4, at 45.

79. *Id.*

80. *See id.* at 179–80; *Environmental Benefits of Natural Gas*, AM. GAS ASS'N, http://www.aga.org/ourissues/issuesummaries/Pages/EnvironmentalBenefitsofNaturalGas.aspx (last visited June 25, 2013). As of the date this paper was submitted to the WGC, the economic outlook for the coming years remains uncertain, "amid fears of a double-dip recession and burgeoning government budget deficits." IEA WEO-2010, *supra* note 4, at 179–80. Despite this uncertainty, history has shown that, while economic forces may lead to ups and downs in terms of energy demand, over the long-term, future energy demand is projected to grow, and along with it the roles of natural gas and LNG in the

natural gas was that in the face of continuing global economic challenges—with most governments facing huge budget deficits—it seemed unlikely that governments, the industry, and the private sector would commit trillions of dollars in investment needed for renewables.[81] According to the *World Energy Outlook 2010* (WEO-2010), approximately eighteen trillion dollars of additional spending is needed on low-carbon energy technologies.[82]

In November 2010, the IEA issued its annual World Energy Outlook, WEO-2010, that explicitly highlighted the increased role that natural gas would play in the 21st century.[83] In WEO-2010, the IEA raised the question of "are we entering the Golden Age of Gas?" and noted that while this may be an exaggeration, natural gas was "certainly set to play a central role in meeting the world's energy needs for at least the next two-and-a-half decades."[84]

In WEO-2010, the IEA acknowledged at the outset that while the pace of the global economic recovery was key to energy prospects in the near term, it is how governments respond to the "twin challenges of climate change and energy security, that will shape the future of energy in the longer term."[85] The IEA went on to present several policy scenarios that differed according to the level of commitment to these challenges.[86]

The *Current Policy Scenario* assumes that no policy commitments—to meet climate change goals—are acted upon.[87] In contrast, the *New Policies Scenario* takes account of the broad policy commitments and plans that have been announced by countries around the world, including national pledges to reduce greenhouse gas emissions and phase out fossil-energy subsidies, and assumes that governments will actually implement the

global energy mix. *See id.* at 60, 77, 179.

81. *See* IEA WEO-2010, *supra* note 4, at 283.

82. *Id.* at 400.

83. *See id.* at 180.

84. *Id.* at 179–80.

85. *Id.* at 45.

86. *See id.* at 79 (noting the three scenarios used "differ with respect to what is assumed about future government policies related to the energy sector").

87. *See id.*

policies and measures to meet the set goals.[88] The *450 Scenario* sets out an energy pathway consistent with the goal of reducing greenhouse gas emissions in order to limit global temperature increases to 2°C.[89] For purposes of this discussion, the focus will be on the *New Policies Scenario*.

The *New Policies Scenario* was centered around several themes, each of which are discussed in detail below: (1) world energy demand increases significantly in the coming decades under any scenario, (2) natural gas will play a central role in meeting energy demand, and (3) climate change emissions targets and the impact on the energy sector.[90]

D. World Energy Demand Grows Under Any Scenario

In the *New Policies Scenario*, the IEA assumed that world economic growth averages 3.2% per year between 2008 and 2035 with non-OECD countries showing the highest growth.[91] World primary energy demand increases by thirty-six percent between 2008 and 2035, or 1.2% per year on average, with non-OECD countries accounting for ninety-three percent of the projected increase in world primary energy demand.[92]

In particular, the IEA noted that "[i]t is hard to overstate the growing importance of China in global energy markets."[93] In 2009, "China overtook the United States . . . to become the world's largest energy user."[94] Between 2000 and 2008, "China's energy consumption . . . was more than four times greater than in the previous decade" and it "contributes 36% to the projected growth in global energy use".[95] Even greater growth is projected in the coming decades "given that China's per-capita [energy] consumption level remains low" compared to the OECD average, and that China, with 1.3 billion people, is the world's most

88. *Id.*

89. *See id.* (noting that greenhouse-gas emissions would need to be reduced to "around 450 parts per million of CO_2 equivalent (ppm CO_2-eq)").

90. *Id.* at 180, 238.

91. *See id.* at 68.

92. *Id.* at 46–47.

93. *Id.* at 47.

94. *Id.*

95. *Id.*

populous nation.[96] "By 2035, China accounts for 22% of world [energy] demand, up from 17% today."[97]

As a result of China's importance, global energy projections remain highly sensitive to the key variables that drive energy demand in China, including prospects for economic growth and developments in energy policy.[98] This is a critical factor that will come up again in the IEA's *Golden Age of Gas*.[99]

"India is the second-largest contributor to the increase in global [energy] demand to 2035, accounting for 18% of the rise."[100] "Outside Asia, the Middle East experiences the fastest rate of increase, at 2.0% per year."[101] In terms of OECD countries, energy demand growth rises slowly until 2035, with the United States projected to be the second-largest energy consumer, China the first, and India a distant third.[102]

E. Natural Gas Will Play a Central Role in Meeting the Energy Demand in 2035

In terms of gas demand and trends, the IEA *WEO-2010 New Policies Scenario* highlighted the fact that natural gas is "set to play a central role in meeting the world's [growing] energy needs for at least the next two-and-a-half decades."[103]

Under each of the three policy scenarios, natural gas "is the only fossil fuel for which demand is higher in 2035 than in 2008 . . . , [al]though it grows at markedly different rates" depending on the scenario.[104] "In the New Policies Scenario, demand . . . [reaches] 4.5 trillion cubic meters (tcm) in 2035—an increase of 1.4 tcm, or 44%, over 2008 and an average rate of increase of 1.4% per year."[105]

Non-OECD countries are the key drivers of demand growth

96. *Id.*
97. *Id.*
98. *Id.* at 97–98.
99. *See infra* Part III.
100. IEA WEO-2010, *supra* note 4, at 84.
101. *Id.* at 84–85.
102. *Id.* at 85.
103. *Id.* at 180.
104. *Id.* at 179–80.
105. *Id.* at 180.

and account for over eighty percent of the growth in gas demand until 2035, primarily because non-OECD economies and population grow much faster, therefore requiring more energy use.[106] China's demand grows the fastest, at an average rate of almost six percent per year, and accounts for more than one-fifth of the increase in global demand until 2035.[107] The potential for Chinese gas demand to grow even faster, depending on whether coal use is restrained for environmental reasons, led the IEA to note that "China could lead us into a golden age for gas."[108]

Although growth in gas demand is the highest in China, somewhat surprisingly, demand growth for natural gas in the Middle East increases almost as much as projected in China, primarily driven by the power sector.[109] India is also a key source of demand growth for natural gas.[110] Growth in gas demand in OECD countries is considerably slower than in the non-OECD countries,[111] although the United States and Europe remain two of the largest users of natural gas through 2035.[112]

1. Power Generation Drives Demand Growth

For most regions of the world, increased use of natural gas for power generation is the main driver of growth in gas demand.[113] According to the IEA, the world is undergoing a period of profound change in the way electricity is generated, as governments shift to low-carbon technologies and fuels "to enhance energy security and to curb emissions of CO_2."[114] In non-OECD countries, electricity demand is rising rapidly and natural gas-fired power plants are easier, less costly and quicker

106. *Id.* at 84, 181.

107. *Id.* at 181.

108. *Id.* at 49.

109. *Id.* at 182.

110. *See id.* at 182 ("India's demand [for natural gas] grows almost as fast as China's, at 5.4% per year.").

111. *See id.* at 182 tbl.5.2 (showing growth at a rate of 0.5% for OECD and 2.0% for non-OECD regions).

112. *Id.*

113. *Id.* at 183.

114. *Id.* at 50.

to build than other forms of power generation plants.[115] In OECD countries, natural gas-fired power is competitive with coal due to proposed CO_2 prices and policies, which are assumed to be implemented.[116] The IEA has noted that "[w]orld electricity demand is expected to continue to grow more strongly than any other final form of energy . . . , grow[ing] by 2.2% per year between 2008 and 2035, with more than 80% of the increase occurring in non-OECD countries."[117] "In China, electricity demand triples between 2008 and 2035. Over the next fifteen years, China is projected to add generating capacity equivalent to the current total installed capacity of the United States."[118]

2. Energy Poverty

In its WEO-2010, the IEA also recognized the concept of "energy poverty."[119] This emerging concept recognizes that despite the projected increase in energy use around the world, many households in the developing world still lack access to modern energy services.[120] "The numbers are [quite] striking: [the IEA estimates] that 1.4 billion people—over 20% of the global population—lack access to electricity and that 2.7 billion people . . . [still] rely on the traditional use of biomass for cooking."[121] The IEA notes in the *New Policies Scenario* that energy poverty persists in 2030 and that "substantial progress is [needed] on improving energy access" in the coming decades.[122]

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115. *See* EXXONMOBIL, 2010 FINANCIAL & OPERATING REVIEW 6–9 (2010), *available at* http://www.exxonmobil.com/Corporate/Files/news_pubs_fo_2010.pdf (explaining that global demand for electricity is likely to rise by more than eighty percent from 2005 to 2030, due primarily to the increasing energy needs of non-OECD countries; that demand can be satisfied by using gas-fired power plants, which are "based on proven technology, can be built quickly and economically, and will produce up to 60-percent fewer CO_2 emissions than coal-fired plants").

116. IEA WEO-2011, *supra* note 1, at 106.

117. IEA WEO-2010, *supra* note 4, at 50.

118. *Id.*

119. *Id.* at 56.

120. *Id.*

121. *Id.*

122. *Id.*

3. *Natural Gas for Transportation*

In the *New Policies Scenario*, natural gas use in the transportation sector accounts for just four percent of additional demand during 2008 to 2035.[123] Nearly all new gas consumption from natural gas used in vehicles is from compressed natural gas (CNG).[124] "Non-OECD Asia, Latin America and OECD North America are responsible for the bulk of the increase" in demand.[125] The greatest potential may be in North America due to low natural gas prices driven by increased production of shale gas.[126]

The scope of demand for natural gas in the transportation sector depends on the future market penetration of natural gas vehicles (NGVs) that today comprise a very small share of the world car fleet (less than one percent) and face significant infrastructure hurdles.[127] The greatest potential seems to be with heavy duty vehicles that are primarily used in fleets and thus face less infrastructure costs.[128]

4. *Climate change emissions targets and the impact on the energy sector*

Under the Copenhagen Accord, countries made commitments to reduce their greenhouse gas emissions with the ultimate goal of limiting the global temperature increase to 2˚C.[129]

In WEO-2010, the IEA noted at the outset of its discussion of climate change and the energy sector that the commitments announced under the Copenhagen Accord collectively fall short of what would be required to put the world on a path to achieving the 2˚C goal.[130]

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123. IEA WEO-2011, *supra* note 1, at 107.
124. *Id.*
125. *Id.*
126. *Id.* at 53.
127. *See* IEA WEO-2010, *supra* note 4, at 112.
128. *Id.* at 186.
129. *Id.* at 45.
130. *Id.*

Under the *New Policies Scenario*,[131] the IEA assumes that countries act upon the commitments in a cautious manner, which has some impact, but that rising demand for fossil fuels will continue to drive up energy-related CO_2 emissions through 2035.[132] "Such a trend would make it all but impossible to achieve the 2˚C goal, as the required reductions in emissions after 2020 would be too steep."[133] According to the IEA, current emission trends are in line "with stabilising the concentration of greenhouse gases at just over 650 [parts per million] or CO_2-eq, resulting in a likely temperature rise of more the 3.5˚C in the long term."[134] In order to have a reasonable chance of achieving the 2˚C goal, much more vigorous action is needed.[135] The "vigorous action" needed is set out in the IEA's *450 Scenario,* which notes that in order to achieve the 2˚C goal, "the concentration of greenhouse gases would need to be stabilized at a level no higher than 450 parts per million" of CO_2-eq.[136] Under this Scenario, much more ambitious targets than those announced under the Copenhagen Accord are assumed, as are more "rapid implementation of the removal of fossil-fuel subsidies as agreed by the G-20."[137] These actions bring about a faster transformation of the global energy sector and a correspondingly faster slowdown in global CO_2 emissions.[138] Under the *450 Scenario*, oil demand peaks before 2020, coal demand peaks before 2020, and natural gas demand peaks before the end of the 2020s.[139] The share of renewables and

131. *See generally id.* at 95–97 (giving an overall summary of the International Energy Agency's assumptions of emission growth under the *New Policies Scenario*).

132. *Id.* at 95 (stating that while "CO_2 emission increase by 21% between 2008 and 2035" the average rate of growth is 0.7% under the New Policies Scenario, as compared to 1.4% under the Current Policies Scenario).

133. *Id.* at 53.

134. *Id.* at 97.

135. *See id.* at 96–97, 380 (stating that in order to meet the 2º C goal, CO_2 levels would have to be reduced to 450 parts per million compared to 650 parts per million under the *New Policies Scenario*).

136. *Id.* at 380.

137. *Id.* at 381.

138. *See id.* at 384 (showing in Figure 13.2 that implementation of the 450 Scenario would result in a rapid deduction in CO_2 emissions).

139. *Id.* at 54.

nuclear increases to thirty-eight percent in 2035 and "additional spending on low-carbon energy technologies (business investment and consumer spending) amounts to $18 trillion (in year-2009 dollars)."[140]

III. The Golden Age of Natural Gas

In early 2011, several significant events transpired that called into question some of the key assumptions in WEO-2010.[141] As a result of the potential cumulative impact of these events the IEA released, in June 2011, a Special Report titled "Are We Entering a Golden Age of Gas?" (*Golden Age of Gas Report*) which presents a new natural gas focused scenario (*GAS Scenario*).[142]

The *GAS Scenario* takes the IEA's WEO 2010 *New Policies Scenario* "as its starting point, . . . but incorporates some new assumptions about policy, prices and other drivers that affect gas demand and supply prospects" over the coming decades.[143] Under the new *GAS Scenario*, global use of natural gas rises by more than fifty percent from 2010 levels with global gas demand increasing nearly two percent per year.[144] In fact, natural gas is the fastest growing fossil fuel and is expected to overtake coal before 2030, and comprise twenty-five percent of the world's fuel mix by 2035.[145]

In the *Golden Age of Gas Report*, the IEA indicated that several factors arose in early 2011 that point to a future in which natural gas plays a greater role in the global energy mix.[146] These factors, which will be addressed in detail below include: (1) increased demand from China as set forth in China's 12th Five-Year Plan, (2) lower growth of nuclear power as a result of the March 2011 nuclear crisis at Japan's Fukushima Daiichi power plant, (3) more planned use of natural gas in

140. *Id.*
141. *See* IEA WEO-2011, *supra* note 1, at 7.
142. *Id.* at 11, 129.
143. *Id.* at 14.
144. *Id.* at 19.
145. *Id.*
146. *Id.* at 81.

transportation, and (4) continued increase of availability of gas, mainly through increased shale gas production, which lowers average gas prices.[147]

The Report strikes a cautious note about the role of natural gas to meet climate change targets, and notes that although natural gas is the cleanest burning fossil fuel, an expansion of natural gas is not enough on its own to put the world on the agreed path of limited carbon emissions consistent with a temperature rise of no more than 2˚C.[148]

A. *Increased Demand from China—China's 12th Five-Year Plan*

One of the key policy drivers noted in the *GAS Scenario* was China's recently announced (March 2011) 12th Five-Year Plan (FYP) for 2011–2015, which "maps a path for a more sustainable economic growth, focusing on energy efficiency and the use of cleaner energy sources" to mitigate environmental impacts.[149] China's 12th FYP sets out targets for China's primary energy mix with natural gas targeted to comprise an 8.3% share of primary energy mix in 2015 (260 bcm annually)—up from 3.8% of energy use in 2008 (85 bcm consumed).[150] This is a significant upward revision from the IEA WEO-2010 *New Policies Scenario*, in which China's demand was projected to reach 170 bcm in 2015.[151] Like many countries, "China is encouraging natural gas use in all sectors in the longterm. However, in the near term, priority is given to . . . power generation."[152] Given its enormous demand for energy, China is widely regarded as one of the most important countries in terms of future energy markets and the trajectory of global gas demand.[153] China alone is expected to make up nearly thirty percent of the global growth in demand for natural gas and by 2035, it is expected that China will use as much natural gas as the EU.[154]

147. *Id.* at 8–9, 101–02.
148. *Id.* at 43.
149. *Id.* at 15.
150. *Id.* at 14–15.
151. *Id.* at 14.
152. *Id.* at 15.
153. *Id.* at 15.
154. *Id.* at 21, 42.

Other key growth regions noted in the IEA's Golden Age Scenario include the Middle East North Africa (MENA) Region which sees an increase in gas demand from 300 bcm to 630 bcm by 2035.[155] Demand for natural gas in India and Latin America also sees significant growth.[156] These countries, along with other non-OECD countries, account for eighty percent of demand growth to 2035.[157]

B. Lower Growth of Nuclear Power—Japan's Fukushima Daiichi Crisis

Another key event relevant to the IEA's *GAS Scenario* was the March 2011 disaster at the Fukushima Daiichi nuclear power plant in Japan.[158] As a result of that incident, many countries around the world are re-thinking, and in some cases, suspending, their nuclear programs. It is now assumed that there will be less global nuclear power generation capacity added than was forecasted in the WEO-2010 *New Policies Scenario*.[159]

This lost nuclear power generation will most likely be replaced by gas-fired power generation, thereby leading to an increase in natural gas demand.[160] Japan's nuclear crisis has

155. *Id.* at 22.

156. *Id.* at 21–22.

157. *Id.* at 13.

158. On March 11, 2011, Japanese authorities informed the International Atomic Energy Agency (IAEA) that an earthquake and tsunami had struck Japan, resulting in damage to Japan's Fukushima Daiichi nuclear power plant. Japanese officials subsequently declared a nuclear emergency when flooding caused by the tsunami disabled the diesel generators that were supposed to provide back-up electricity to the plants cooling system. *Fukushima Nuclear Accident Update Log*, INT'L ATOMIC ENERGY AGENCY [IAEA] (Mar. 11, 2011), http://www.iaea.org/newscenter/news /2011/ fukushima110311.html. As the tragedy in Japan unfolded, many countries began reviewing the safety of their own existing nuclear facilities and started to re-think previous plans for new nuclear installations. IEA WEO-2011, *supra* note 1, at 102.

159. IEA WEO-2011, *supra* note 1, at 16.

160. *Id.* at 101–02. The IEA has cautioned that "Germany's moratorium on nuclear-power generation will add around 25 million metric tons a year to the country's carbon-dioxide emissions, which will have to be offset elsewhere by replacing coal-fired power with cleaner gas-burning plants." James Herron, *IEA Warns on Impact of German Nuclear Halt*, WALL. ST. J., May 27, 2011, http://online.wsj.com/article/ SB10001424052702304520804576348943486991956.html.

reverberated through the LNG market as Japan has had to import record amounts of LNG to make up for the nuclear power lost in the wake of the crisis.[161] Japan's imports of LNG for April 2011 were twenty-three percent higher than April 2010, and many analysts assume this elevated demand will continue through 2011–2012.[162] Analysts also assume that Japan's increased use will absorb any excess supply of LNG, and may possibly even lead to a global LNG shortage which will drive up LNG prices in other markets, most notably Europe.[163]

C. Natural Gas in Transportation

The IEA's *GAS Scenario* "assume[s] that governments in some countries . . . [will] encourage the introduction of greater numbers of natural gas vehicles (NGVs) than in the New Policies Scenario."[164] The *New Policies Scenario* projected around thirty million NGVs by 2035, while the *GAS Scenario* projects around seventy million.[165]

D. Price and Supply of Natural Gas

In the *GAS Scenario*, the IEA noted the importance that price plays as a key determinant of the level of future global gas demand and the price assumptions for natural gas in the *GAS Scenario*, are markedly different when compared to the *New Policies Scenario*.[166]

In the *GAS Scenario*, "the rate of increase . . . slow[s] around the middle of the Outlook period before accelerating again as it approaches 2035."[167] The price path set out by the IEA reflects

161. James Herron, *Japan LNG Imports Surge, Supporting Global Prices*, MARKETWATCH, May 17, 2011, http://www.marketwatch.com /story/japan-lng-imports-surge-supporting-global-prices-2011-05-17.

162. *Id.*

163. *Id.*; *Japanese Utilities Prepare to Step Up LNG Imports to Meet Summer Electricity Demand, Report to Country & Industry Forecasting*, IHS: CURRENT INSIGHTS, (June 10, 2011), http://www.ihs.com/products/global-insight/industry-economicreport. aspx?ID=1065 929775.

164. IEA WEO-2011, *supra* note 1, at 16.

165. *Id.*

166. *Id.* at 17.

167. *Id.*

much more optimistic assumptions relating to increases in future gas supply, largely driven by expected increases in shale gas production.[168]

Table 1.Natural gas import price assumptions by scenario (in year 2009 dollars per MMBtu)[169]

		GAS Scenario					New Policies Scenario				
	2009	2015	2020	2025	2030	2035	2015	2020	2025	2030	2035
United States	4.1	5.6	6.1	6.4	7.0	8.0	7.0	8.1	9.1	9.9	10.4
Europe	7.4	9.0	9.5	9.7	10.1	10.9	10.6	11.6	12.3	12.9	13.3
Japan	9.4	11.5	11.7	11.9	12.3	12.9	12.2	13.4	14.2	14.9	15.3

E. Climate Change and the Role of Natural Gas in the GAS Scenario

In order to meet the globally agreed upon target of limiting temperature increase to 2˚C, "the long-term concentration of greenhouse gases in the atmosphere must be limited to around 450 parts per million of CO_2-equivalent, only a 5% increase compared to an estimated 430 parts per million in 2000."[170] Even though natural gas is the cleanest burning fossil fuel when compared to other fossil fuels, such as coal, "[e]nergy-related CO_2 emissions in the GAS Scenario follow a path similar to that in the New Policies Scenario, reaching 35.3 gigatones (Gt) in 2035, [which is] a mere 160 million tones (Mt) lower than

168. *Id.*

169. IEA WEO-2011, *supra* note 1, at 17.

170. Press Release, International Energy Agency, Prospects of Limiting the Global Increase in Temperature to 2°C is Getting Bleaker (May 30, 2011), *available at* http://www.iea.org/newsroomandevents/news/2011/may/name,19839,en.html.

emissions in the New Policies Scenario in that year."[171]

In noting the competing interactions among natural gas emissions benefits, prices and renewables, the IEA has recognized that while low natural gas prices encourage displacement of more carbon intensive fuels such as coal and oil, in the absence of a global cap on CO_2 emissions, low natural gas prices may also displace more expensive low-carbon fuels such as nuclear fuels and renewables.[172] As a result, the IEA has stated that an increased share of natural gas in the global energy mix is not enough on its own to put us on a carbon emissions path consistent with an average global temperature rise of no more than 2°C.[173] To meet this target, the world needs a "greater shift to low-carbon energy sources, increased efficiency in energy usage and new technologies, including carbon capture and storage."[174]

While the *GAS Scenario* assumes that "governments will continue to provide regulatory and financial support for renewables" (WEO-2010 estimated fifty-seven billion dollars of support for renewables and biofuels), it was noted that "lower gas prices may put pressure on some governments to review their policies and level of support."[175] Thus, it remains to be seen whether there will be any net benefit from an increase in natural gas use over other more carbon intensive fuels such as coal and oil.

F. Are We Entering a Golden Age of Natural Gas?

The above sections highlight the competing interactions at work as natural gas struggles to find its role in the future energy supply mix. On the one hand, natural gas is a clean burning, abundant and flexible fuel that can be used in power generation and other sectors to help reduce emissions by displacing more emissions intensive fuels, such as coal and

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171. IEA WEO-2011, *supra* note 1, at 37.

172. *Id.*

173. *Id.* at 43 (noting that limiting the increase in global temperature would "require much improved energy efficiency, a greater shift to low-carbon energy sources and wide application of new technologies").

174. *Id.* at 8–9.

175. *Id.* at 18.

oil.[176] However, the emissions benefits of natural gas, on their own, will not be enough to meet global climate change goals, especially if low natural gas prices lead to displacement of other cleaner fuels such as nuclear and renewables.[177] After weighing these factors and recognizing that there are many uncertainties that may tip the scales, the IEA noted in the *GAS Scenario* that with natural gas demand expected to "rise by more than 50% and account for over 25% of the world demand in 2035," the Golden Age of Natural Gas is upon us.[178]

IV. THE ROLE OF LNG IN THE GOLDEN AGE OF GAS

The Golden Age of Gas would not be possible were it not for liquefied natural gas (LNG).[179] LNG is simply natural gas that has been cooled to approximately -161°C, at which point it condenses to a liquid that can then be shipped via LNG tanker or stored.[180] Since the majority of natural gas reserves are located away from key markets, LNG offers an important solution for the global gas markets in terms of moving natural gas to markets where it is most needed.[181]

Between 2002 and 2007, global LNG trade "expanded by around 50%, . . . followed by almost no growth in 2008 and early 2009 due to upstream issues in major producing countries" and the fall in demand due to the global economic recession.[182] Trade in LNG resumed its upward trajectory in 2010.[183] According to the IEA, international trade in natural gas is set to grow significantly in the coming decades with more than half of that growth in the form of LNG.[184] Current projections are for global LNG trade to increase by one third from 2011 to 2017 with many countries, particularly from the Pacific Basin, looking to

176. *Id.* at 9, 60, 81.

177. *Id.* at 43.

178. *Id.* at 9.

179. *See id.* at 31–32.

180. *LNG: A Liquid Market*, *supra* note 5.

181. *See id.* (identifying major producers of LNG that are distant from their consumers, and highlighting the influence of transport expenses on LNG costs).

182. MEDIUM-TERM OIL & GAS MARKETS 2010, *supra* note 7, at 168.

183. *Id.*

184. IEA WEO-2010, *supra* note 4, at 192.

LNG.[185]

The significant increase in LNG trade, particularly between historically distinct regions, has led many to question in recent years whether the gas markets were globalizing.[186] The general consensus that seems to have emerged is that while the gas markets are globalizing, they are not yet globalized since the majority of global gas is still consumed in the country where it is produced and because there is not a single pricing structure for LNG.[187] Nonetheless, there is widespread recognition that LNG is the "glue" linking global gas markets.[188]

A. The Evolution of LNG Trade—From Regional to Global

As the LNG markets evolved over the decades, they tended to develop in regional isolation from one another with relatively few sellers supplying relatively few buyers.[189] This "niche" business has historically been divided into two distinct LNG trade regions—the Asia Pacific region and the Atlantic Basin Region, which includes North America, South America and most of Europe.[190] Until recent years, there was very little trade in terms of a spot or short-term market, and likewise, there were very few cargo diversions from the originally intended destination.[191]

In addition to most LNG trade occurring regionally, until recently, the vast majority of the cargos to those regions were committed under long-term contracts that were generally required to underpin the financing and capital investment required for the capital-intensive LNG projects.[192] The typical

185. Maria van der Hoeven, Executive Director, IEA, Remarks at Singapore International Energy Week: Asia and the Global Energy Economy, (Oct. 21, 2012), *available at* http://www.iea.org/ newsroomandevents/speeches/SIEWspeech.pdf.

186. *See* MEDIUM-TERM OIL & GAS MARKETS 2010, *supra* note 7, at 158–60.

187. *Id.*

188. *Id.* at 158.

189. Stephen Thompson, *The New LNG Trading Model Short Term Market Developments and Prospects*, INT'L GAS UNION, http://www.igu.org/html/wgc2009/papers/docs/wgcFinal00351.pdf (last visited June 25, 2013).

190. *Id.*

191. *Id.*

192. *Id.*

LNG contract generally specifies delivery of gas to a particular location for a duration of 20–25 years.[193]

> Historically, these contracts have usually been structured on a take-or-pay basis for specified volumes, with pricing linked either to crude oil or a basket of crude oil and refined products. In this way, risk is shared between the LNG supplier and the buyer where the supplier assumes the price risk and the buyer assumes the volume risk.[194]

In more recent years, global LNG trade patterns have shifted, with more LNG being traded between the historically distinct LNG regions and more players entering the market.[195] In 2011, "world LNG trade grew by 8% . . . to a new high of 241.5 [million tons]."[196] Even more remarkable than the growth in overall LNG trade is the growth of the number of countries now involved in LNG—either as an exporter or an importer.[197] "In 2006, only 13 countries exported LNG: Algeria, Australia, Brunei, Egypt, Indonesia, Libya, Malaysia, Nigeria, Oman, Qatar, Trinidad & Tobago, the United Arab Emirates, and the United States."[198] Another five countries (Equatorial Guinea, Norway, Peru, Russia, and Yemen) have since joined the list of exporters, with additional countries constructing export facilities, such as Papua New Guinea.[199]

On the import side, there is a long-standing list of LNG importing countries, including: Belgium, the Dominican Republic, France, Greece, India, Italy, Japan, Portugal, Puerto Rico, the Republic of Korea, Spain, Taiwan, Turkey, the United Kingdom and the United States.[200] Since 2006, another eight

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193. Andrew Slaughter et al., *Liquefied Natural Gas (LNG)* 1–2 (Nat'l Petroleum Council, Topic Paper No. 13, 2007).

194. *Id. at 2*.

195. *See* INT'L GAS UNION, WORLD LNG REPORT 2011, 9 (2011) [hereinafter IGU WORLD LNG REPORT], *available at* http://www.igu.org/igu-publications/LNG%20Report%202011.pdf (last visited June 25, 2013) (noting the experiences of Qatar and the other new players in the market).

196. *Id.* at 6.

197. *Id.* at 6–7.

198. *Id.*

199. *Id.*

200. *Id.*

countries have become LNG importers: Argentina, Brazil, Canada, Chile, China, Kuwait, Mexico, and the United Arab Emirates.[201]

Interestingly, a mere decade ago, many of the countries now importing LNG were not even considered to be potential future importers.[202] The most dramatic turn of events involves the United States, which in the past five years has swung from being considered as potentially the world's largest LNG importer to now being considered as one of the world's largest potential LNG exporter.[203]

This significant growth in LNG trade over the past few years has led many to question whether the LNG markets have become "globalized" and whether LNG could ever trade as a global commodity.[204] In order for this to happen, a number of factors would have to converge including (1) increased patterns and flow of international trade of LNG, (2) the establishment of a single price, (3) liquid trading, and (4) flexibility of supply.[205] Of these, the establishment of a single price is perhaps the most complicated and difficult to achieve due to differences in the global pricing of natural gas.[206]

B. Traditional Pricing Structure for LNG—Oil Linked Pricing

The vast majority of the world's LNG trade (approximately seventy percent) is priced using a competing fuels index, generally based on crude oil or fuel oil, and referred to as "oil price indexation" or "oil-linked pricing."[207] "The original

201. *Id.*

202. *Id.*

203. *Id.*

204. MEDIUM-TERM OIL & GAS MARKETS 2010, *supra* note 7, at 158.

205. *An Unconventional Bonanza*, *supra* note 9; Robert Johnston, *Fungible Supply, Flexible Markets: Canada LNG Strategy Aligns with Emerging Global Gas Market*, ENERGY BRIDGE (Jul. 5, 2011), http://www.energybridge.ca/magazine/articles/entry/fungible-supply-flexible-markets-canada-lng-strategy-aligns-with-emerging-global-gas-market.

206. *An Unconventional Bonanza*, *supra* note 9.

207. AUSTL. GOV'T BUREAU OF RES. & ENERGY ECON. (BREE), GAS MARKET REPORT 41 (2012) [hereinafter BREE], *available at* http://www.bree.gov.au/documents/publications/gas-market/gas-market-report.pdf. "This is the first of what is planned to be an annual report on the current state and projected developments in

rationale for oil-linked pricing was that the price of gas should be set at the level of the price of the best alternative to gas."[208] Historically, the best alternative was heavy fuel oil, crude oil or gas oil.[209] While the substitutability of oil and gas has decreased over time, the traditional oil-linked pricing remains.[210] Accordingly, for many regions of the world, natural gas prices fluctuate in line with oil prices.[211] This is true for most European markets (except for the United Kingdom) where the linkage between gas and oil prices is typically formalized by contract, so as oil prices move, gas prices automatically follow.[212] In more recent years, the two largest gas markets in Europe, the UK and Germany, have set the two universally accepted reference points for natural gas prices—the UK National Balancing Point (NBP) and the German Border Price (GBP).[213]

"In the United Kingdom, more than half the gas consumed is traded on spot markets with the virtual National Balancing Point (NBP) as the key trading point in the entry/exit based system."[214]

Recent long-term contracts supporting large infrastructure

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international and domestic gas markets." *Id.* at 1.

> The Bureau of Resources and Energy Economics (BREE) is a professionally independent, economic and statistical research unit within the Australian Government's Resources, Energy and Tourism (RET) portfolio. The Bureau was formed on 1 July 2011 and its creation reflects the importance placed on resources and energy by the Australian Government and the value of these sectors to the Australian economy.

Id. at ii.

208. *Id.* at 41.

209. *Id.*

210. *Id.*

211. *An Unconventional Bonanza*, *supra* note 9.

212. *Id.*

213. ANTHONY J. MELLING, NATURAL GAS PRICING AND ITS FUTURE: EUROPE AS THE BATTLEGROUND 31 (2010), *available at* http://www.carnegieendowment.org/files/gas_pricing_europe.pdf. This report is adapted from a 2009/2010 study commissioned by Cheniere Energy Partners and submitted as part of Cheniere's application for approval to export LNG. *Id.* at 5.

214. Susan L. Sakmar & Donald R. Kendall, Jr., *The Globalization of LNG Markets: Historical Context, Global Trends and Prospects for the Future*, PROC. OF THE 1ST ANN. GAS PROCESSING SYMP. 32, 35 (2009).

projects between the United Kingdom and Qatar were at NBP prices rather than oil prices.[215] "The other half [of the UK gas market] is delivered according to terms of old North Sea prices, which incorporate many indices such as coal, inflation, electricity, fuel oil and gas oil."[216]

"The German Border Price (GBP) is published in Germany by Bundesamt fur Wirtschaft und Ausfuhrkontrolle (BAFA) each month."[217] BAFA publishes the total value of gas imports into Germany during each month and the total quantity in energy units. The GBP price is determined by dividing the total value by the quantity to obtain the average gas prices known as the GBP.[218]

In the Asia-Pacific region, LNG contracts are typically based on the historical linkage to the Japanese Customs-cleared Price for Crude Oil (JCC, or the "Japanese Crude Cocktail").[219] This is because when LNG trade first started in Japan, Japanese power generation was heavily dependent on oil, so early LNG contracts were linked to JCC in order to negate the risk of price competition with oil.[220] The formula used in most of the Asia LNG contracts that were developed in the late 1970s and early 1980s can be expressed by: $\mathbf{P_{LNG} = (\alpha \bullet P_{crude}) + \beta.}$ [221]

Where P_{LNG} = price of LNG in USD/MMBtu (USD/GJ x 1.055)

P_{crude} = price of crude oil in USD/barrel

α = crude linkage slope

215. INT'L ENERGY AGENCY, NATURAL GAS MARKET REVIEW 83 (2006) [hereinafter NATURAL GAS MARKET REVIEW 2006], *available at* http://www.iea.org/publications/freepublications/publication/gasmarket2006.pdf.

216. *Id.*

217. MELLING, *supra* note 213, at 31.

218. *Id.*

219. James T. Jensen, Asian Natural Gas Markets: Supply, Infrastructure and Pricing Issues 14 (2011), (background paper prepared for the National Bureau of Asian Research), *available at* http://www.jai-energy.com/pubs/nbr.pdf.

220. *See* BREE, *supra* note 207, at 69 (explaining the benefit and motivation behind linking the price of LNG to the JCC).

221. *Id.* at 42.

β = constant in USD/MMBtu
(USD/GJ x 1.055)

"Historically, there was little negotiation between parties over the slope of the LNG contracts" with most disagreements centered on the value of the constant β.[222] "Following the oil price declines of the 1980s, most new LNG contracts incorporated a floor and ceiling price that determined the range over which the contract formula could be applied."[223] Since suppliers had to make "substantial investments in LNG liquefaction trains, a pricing model evolved that provided a floor price."[224] For suppliers, "this floor limits the fall in the LNG price to a certain level even if the oil price were to carry on falling."[225] "Conversely, buyers are protected by a price cap, which restricts LNG price rises when oil prices rise above a certain point."[226]

In North America, the gas market originally operated in a similar manner to the European market with long-term, oil based contracts.[227] When the North American gas markets were liberalized in the 1980s and 1990s, a "hub" system developed whereby natural gas is now traded at over forty principle centers, or hub's, spread across North America.[228] The best known is Henry Hub in Louisiana, which serves as the pricing reference for NYMEX gas futures contracts.[229] In many countries, including countries in the Middle East, North Africa, Latin America, the former Soviet Union and most of Arica, gas prices are set without any linkage to oil or costs and gas prices barely cover production costs.[230]

222. *Id.*
223. *Id.*
224. NATURAL GAS MARKET REVIEW 2006, *supra* note 215, at 83.
225. *Id.*
226. *Id.*
227. *Id.* at 85.
228. *Id.*
229. *Id.*
230. IGU WORLD LNG REPORT, *supra* note 195, at 18.

C. Recent Pricing Issues

In terms of price, the last few years can be analyzed in three different stages. The first stage, from mid-2007 to mid-2008, represents the time when "gas market prices, along with other fuel prices, were increasing and regional prices increasingly converged, reflecting tightening gas markets."[231]

In the second stage, mid-2008 to mid-2009, all regional prices decreased due to the global recession.[232] But by the end of 2009 and into the first half of 2010, the spot price for natural gas weakened significantly relative to oil prices.[233] This "decoupling" was primarily due to two things happening on the supply side—the surge in LNG capacity when new production came on-line and the unexpected boom in shale gas production in North America.[234] The increase in supply coming at a time when demand was dropping in the face of recession led to a sizable "glut" of natural gas on the market.[235]

The significant imbalance in the gas markets led to a "large and unprecedented gap" between prices in the competitive markets of North America and the United Kingdom, and those markets where gas was indexed to oil under long-term contracts, namely continental Europe and Asia-Pacific.[236] For example, in 2009, the spot price for Henry Hub (HH) in the United States averaged $4/MMBtu, the UK NBP averaged $5/MMBtu, and Japan and Continental Europe averaged $9/MMBtu.[237]

The price decoupling caused buyers of oil-linked contracts in

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231. IEA, MEDIUM-TERM OIL & GAS MARKETS REPORT 212 (2011) [hereinafter MEDIUM-TERM OIL & GAS MARKETS 2011], *available at* http://www.iea.org/publications/freepublications/publication/mtogm2011_unsecured.pdf.

232. *Id.*

233. IEA WEO-2010, *supra* note 4, at 185.

234. *Id.*

235. *Id.* at 195.

236. *Id.* Because North America is a deregulated market for natural gas, gas is not traded based on an energy-equivalent value of gas verses oil, and the recent ratio of oil to gas prices reflects the huge discount in the value of gas versus oil. *Gas is Worth (a lot) Less than Oil*, ZIFF ENERGY GROUP, *Charts of the Month* (2012), http://www.ziffenergy.com/media/chartsofthemonth.aspx#webchart_5 (comparing the price of natural gas compared to oil on a per energy basis).

237. IEA WEO-2010, *supra* note 4, at 185.

Europe to seek to renegotiate pricing terms with their suppliers.[238] For example, "Russia's Gazprom granted some important concessions on pricing, partially moving from oil to spot gas price indexation over a three-year period causing prices to fall in some key markets like Germany."[239] Buyers were also granted some other concessions to provide them "more flexibility . . . as to when they are required to lift contracted volumes."[240]

The unprecedented decoupling of natural gas prices from oil caused some to question whether the historic link between oil and gas prices was a "divorce" or merely "a temporary separation."[241] At the time, the IEA predicted that as long as the gas supply glut existed, there would be market pressure to move further away from oil indexation, especially for long-term contracts.[242]

"The third stage started in the second quarter of 2010 when HH and NBP spot prices started to diverge" and NBP increased towards the GBP.[243] The unexpected increase in NBP was due to a combination of factors. There were some LNG supply production problems from Norway and Qatar, which took some LNG off the market.[244] There was also a "tightening of the global gas market due to the strong growth in LNG demand in Asia" and a "switching from coal to gas in the European power sector."[245]

"The NBP monthly average day-ahead price in April of 2011 was 85% higher than in the same month of 2010, and more than twice as high as HH."[246] In March 2011, the spread between the U.S. HH and U.K. NBP was "an unprecedented difference of $5.8/MMBtu."[247] The spread between the Asian LNG price and

238. *Id.*

239. *Id.*

240. *Id.*

241. *See id.* (noting the IEA highlighted the separation with a special "spotlight" in the IEA WEO-2010: "Oil and Gas Prices: A Temporary Separation or a Divorce?").

242. *Id.*

243. MEDIUM-TERM OIL & GAS MARKETS 2011, *supra* note 231, at 213.

244. *Id.*

245. *Id.*

246. *Id.*

247. *Id.*

U.S. HH was an even higher $8/MMBtu.[248]

Throughout most of 2011, the Asian and European markets faced rising natural gas prices, while the U.S. HH price declined even further.[249] However, by June 2011, European gas prices were back to the level of October 2008,[250] while U.S. HH prices continued to fall.[251] In 2011, U.S. HH prices sunk to their lowest levels in 10 years, while Europe's prices ultimately stabilized between $8–$10/MMBtu with Japan's LNG import price peaking at $17/MMBtu by late 2011.[252]

D. From Convergence to Divergence: Is the US Market Moving Away?

Since LNG is the "glue" linking global gas markets, the IEA has recently analyzed how LNG arbitrage created a convergence between the markets in 2009–2010 and more recently why the convergence appears to have ended.[253] "In 2007, the average US LNG import price was $0.1/MMBtu [sic] higher than the HH price."[254] This increased to more than $1/MMBtu in 2008 as LNG went to the higher priced NBP markets.[255] "Between 2007 and 2008, US LNG imports dropped more than 50%, from 22 bcm to 10 bcm. In mid-2009, the NBP and HH prices converged, the difference between the HH price and the US LNG import price decreased and US LNG imports increased slightly to around 13 bcm."[256] This convergence continued up to the beginning of 2010 until the NBP and HH prices diverged again with the U.S. LNG import price moving above the HH price

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248. *Id.*
249. *Id.* at 214.
250. *Id.* at 213.
251. *Henry Hub Natural Gas Price History*, REUTERS (May 2, 2012, 10:11 AM), http://www.reuters.com/article/2012/05/02/energy-natgas-hubprices-idUSL1E8G269J20120502.
252. MEDIUM-TERM GAS MARKET REPORT 2012 SUMMARY (2012), *available at* http://www.iea.org/Textbase/npsum/MTGMR2012SUM.pdf.
253. IEA WEO-2010, *supra* note 4, at 158; MEDIUM-TERM OIL & GAS MARKETS 2011, *supra* note 231, at 214.
254. MEDIUM-TERM OIL & GAS MARKETS 2011, *supra* note 231, at 214.
255. *Id.*
256. *Id.*

again.[257]

In analyzing various LNG import prices, it was noted that "several countries (Trinidad, Tobago and Egypt) export their LNG to the US at prices strongly linked to HH."[258] Qatar and Nigeria, which account for twenty-one percent of U.S. LNG imports, export at prices linked to NBP.[259] This results in the average U.S. LNG import price being somewhere between HH and NBP, depending on import volumes from the respective suppliers.[260] "The delta between the LNG import price and the market price is an indication that current US LNG imports, which in 2010 were 12 bcm, are at their minimum and that any cargo that could be re-routed have already been rerouted."[261] In other words, the only LNG that was coming into the United States was that which was under contract and could not be rerouted, with the exception of a small amount of imported LNG necessary to avoid shutting down existing U.S. terminals.[262]

In 2010, it was evident that the U.S. market had become almost immune from global price developments.[263] The U.S. EIA has also noted that US net imports of natural gas have fallen for three consecutive years.[264]

The U.S.'s falling LNG imports is largely due to growing domestic production from shale gas formations, which more than tripled between 2007 and 2010,[265] and which is expected to

257. *Id.*

258. *Id.*

259. *Id.*

260. *Id.*

261. *Id.*

262. *Id. at* 214–15; *see* Donna J. Bailey, *US LNG Import Terminals the Perfect Storm*, *published in* LIQUEFIED NATURAL GAS: THE LAW AND BUSINESS OF LNG, Second Edition (Paul Griffin ed., 2012), at 166. LNG import terminals must be maintained in their cryogenic state in order for them to be able to perform the primary functions of the receipt, storage and regasification of LNG and send-out of natural gas. *Id.* As such, a sufficient quantity of LNG must be retained in the LNG storage and piping systems regardless of whether or not a terminal is importing. *Id.* This became a challenge for U.S. import terminals that faced dwindling imports as market conditions changed due to shale gas production and higher priced LNG markets elsewhere. *Id.*

263. MEDIUM-TERM OIL & GAS MARKETS 2011, *supra* note 231, at 214.

264. *U.S. Natural Gas Imports Fall for Third Year in a Row*, U.S. ENERGY INFO. ADMIN. (Apr. 1, 2011), http://www.eia.gov/to dayinenergy/detail.cfm?id=770.

265. *Id.* (noting "[b]etween 2007 and 2010, annual net imports declined by about

account for forty-nine percent of total U.S. natural gas production in 2035, more than double its twenty-three percent share in 2010.[266]

The surge in U.S. shale gas production has led companies in the United States to seek authorization to export LNG in order to take advantage of the current supply overhang of shale gas and price differentials between the global gas markets.[267] This is a dramatic turn of events from just five years ago when it was widely expected that the United States would need to import LNG![268] According to the IEA, whether the price divergence between the regional LNG markets will continue into the future, depends on whether U.S. shale gas production is sustained and also whether the United States becomes a major LNG exporter.[269] At the time of this writing, these are two of the most talked about issues in the LNG industry with more developments certain to follow in the coming years.[270]

E. The Future Evolution of LNG Markets

The trade in LNG seems likely to continue to globalize in the

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1.2 trillion cubic feet, or nearly one-third. Net imports by pipeline account for over 80% of total net imports and come entirely from Canada (the United States is a net exporter to Mexico). Net pipeline imports fell by 28%. Net imports in the form of liquefied natural gas (LNG) were down nearly 50%.").

266. U.S. ENERGY INFO. AGENCY, ANNUAL ENERGY OUTLOOK 2012 EARLY RELEASE OVERVIEW 1 (2012), *available at* http://www.eia.gov/forecasts/a eo/er/pdf/0383er% 282012%29. By now, it is widely accepted that shale gas development has been a "game changer" in the United States. *Shale Gas Boom a 'Game Changer' for Manufacturing*, ENVTL. LEADER (Feb. 28, 2013), http://www.environmentalleader .com/2013/02/28/shale-gas-boom-a-game-changer-formanufacturing/.

267. *Project Sponsors are Seeking Federal Approval to Export Domestic Natural Gas*, ENERGY INFO. AGENCY, (Apr. 24, 2012), http://www.eia.gov/todayinenergy/detail. cfm?id=5970; Kurt Cobb, *The US Still Imports Natural Gas, so Why the Desire to Export it?*, OILPRICE.COM (Feb. 26, 2013), http://oilprice.com/Energy/Natural-Gas/The-US-still-Imports-Natural-Gas-so-Why-the-Desire-to-Export-it.html.

268. Steven Mufson, *As Shale Gas Booms, U.S. Considers LNG Exports*, WILLITS NEWS, (Dec. 10, 2012), http://www.willitsnews.com/ci_22163548/natural-gas-boom-fracking-lng-export.

269. MEDIUM-TERM OIL & GAS MARKETS 2011, *supra* note 231, at 215.

270. *See, e.g.*, Cobb, *supra* note 267 (discussing sustainability of U.S. LNG and the ability of the U.S. to export LNG as key issues). A detailed discussion of the future of U.S. shale gas development as well as the future of U.S. LNG exports is beyond the scope of this Article, and indeed, could be the basis for at least two more law articles.

coming years and the IEA has recently recognized that "globalization is not only measured by the ratio between LNG trade and total demand, but also by the number of countries (or regions) involved."[271] As discussed above, the number of countries both looking to import and export LNG is increasing and new players are emerging on an almost daily basis.[272] For example, over the past decade, the number of importing countries grew from eleven in 2001 to twenty-five, with eighty-nine LNG regasification terminals (including ten floating facilities) in operation by the end of 2011, compared with forty terminals in 2001.[273] So while LNG has not yet become "commoditized" in the sense that it still does not trade on international markets based on a single pricing structure, there is no doubt that LNG trade has become globalized.

Going forward, most experts expect LNG markets to continue to evolve from the traditional market structure to a more dynamic, flexible structure that better reflects the LNG trade today.[274] As the largest LNG market, whether Asia will continue to follow its oil-linked pricing structure is always discussed at industry conferences. The general consensus seems to be that most people expect the Asian LNG market to develop more "flexible characteristics, including spot trading, a spot price index and more operational flexibility."[275] Nonetheless, at least for the foreseeable future, an oil-linked gas pricing mechanism is likely to remain dominant for long term contract pricing in the Asia Pacific market for several reasons.

"First, LNG producers still require pricing certainty given the high capital costs of developing LNG projects."[276] "Given the increase in capital costs over the past decade," and in particular

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271. MEDIUM-TERM OIL & GAS MARKETS 2011, *supra* note 231, at 185.

272. IGU WORLD LNG REPORT, *supra* note 195, at 6.

273. GIIGNL, THE LNG INDUSTRY IN 2011 7 (2011), *available at* http:// www.giignl.org/fileadmin/user_upload/pdf/A_PUBLIC_INFORMATION/LNG_Industry/GIIGNL_The_LNG_Industry_2011.pdf.

274. ENERGY CHARTER SECRETARIAT, FOSTERING LNG TRADE: DEVELOPMENTS IN LNG TRADE AND PRICING 22 (2009).

275. Pat Roberts, CWC Dynamic Insights Report, (Sept. 2011) (report included as part of the World LNG Series of the Asia Pacific Summit in Singapore).

276. BREE, *supra* note 207, at 43.

the high costs for Australian projects, mechanisms for guaranteeing returns for LNG producers remain critical.[277] While this does not necessarily require that gas prices be linked to oil prices, it supports a long-term contract price which locks in the existing mode of pricing for the duration of the contract.[278] Most, if not all, of the recent Australian LNG projects are underpinned by long-term (15–25 year) contracts linked to oil.[279]

Second, in order for gas and oil prices to decouple in Asian markets, there needs to be an alternative mechanism on which to base prices. This mechanism needs to be transparent to ensure that no party (buyer or seller) is disadvantaged at price settlement. "There is currently no suitable alternative mechanism in the Asian market."[280]

Third, key buyers, such as Japan and Korea, "have limited import options and are currently constrained to LNG-based imports."[281] As such, security of supply is of paramount concern and there is a fear that any alternative pricing mechanisms might jeopardize this.[282]

Given the dynamic nature of global gas markets and the significant price differentials that currently exist between the regions, there are bound to be significant developments in the LNG markets going forward.

V. CONCLUSION—THE FUTURE LOOKS BRIGHT FOR LNG

Going forward, the pace and scale of demand growth for all forms of energy, including natural gas and LNG, ultimately will rest on the climate and energy policies adopted by countries, the global economic recovery, and industry investment.[283] Perhaps the most difficult to predict is global energy policy, since decisions about energy policy are inextricably linked to economic, environmental and national security policy, and have

277. *Id.*
278. *Id.*
279. *Id.*
280. *Id.*
281. *Id.*
282. *Id.*
283. *International Energy Outlook 2011*, U.S. ENERGY INFO. ADMINISTRATION (Sept. 19, 2011), http://www.eia.gov/forecasts/ieo/pdf/0484(2011).pdf.

significant consequences in all three areas.[284]

Nonetheless, in the coming decades, the world must meet the challenge of producing more energy to meet growing worldwide demand while at the same time limiting and, in some countries, even reducing greenhouse gas emissions.[285] This dynamic will create unprecedented challenges but also unprecedented opportunities for cleaner burning fuels to play a significant role in meeting future energy demand.[286] Of critical importance will be the growing role of LNG as more and more countries look to natural gas to meet growing energy demand.[287]

While the pace and scope of the global economic recovery is difficult to predict, the global LNG industry has grown dramatically over the past decade and has proven to be a resilient industry in challenging economic times.[288] Over the long term, all expectations are that the world will continue to need cleaner burning fuels which bodes well for the future of LNG as the "glue" linking global gas markets.

284. Clifford Krauss, *Bigger Than Either of Them?*, N.Y. TIMES (Oct. 23, 2011), http://www.nytimes.com/2012/10/24/business/energy-environment/us-energy-policy-caught-in-the-vise-of-economics-and-politics.html?pagewanted=all.

285. *Power Surge: Energy Use and Emissions Continue to Rise*, WORLD RESOURCES INST., http://www.wri.org/publication/content/8601.

286. *A Cleaner Fuel for the Long Haul*, SHELL GLOBAL, http://www.shell .com/ global/future-energy/smarter-mobility/smarter-products/cleaner-fuel-long-haul.html.

287. *Liquefied Natural Gas is Becoming a More Important Part of the U.S. Energy Market*, MEXIA HOLDINGS, http://mexiaholdings.com/2008/02/25/hello-world/; IGU WORLD LNG REPORT, *supra* note 195, at 3.

288. INT'L GAS UNION, WORLD LNG REPORT 2010, 7–8 (2010); David Wood, *LNG Industry Proves Resilient*, WORLD OIL ONLINE (Feb. 2011), http://www.worldoil.com/ LNG-industry-proves-resilient-February-2011.html.