Spectrum Reallocation and the National Broadband Plan

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I. INTRODUCTION

For more than fifty years, economists and other academics have been calling for a more flexible, dynamic, market-oriented approach to the allocation and assignment of wireless spectrum rights. Policymakers have responded by implementing some meaningful reforms, including the use of auctions for spectrum assignment and the creation of more flexible and tradable licenses to allow spectrum to flow dynamically to its highest value uses. Taken together, the academic literature and the statements (and, to a somewhat lesser extent, the actions) of policymakers suggest the existence of a fairly well-formed and comprehensive consensus about key aspects of spectrum policy.

The National Broadband Plan ("NBP" or "Plan"),[1] released in March 2010, emphasizes the importance of spectrum policy, and focuses on the need to reallocate spectrum from less efficient to more efficient uses. The NBP notes in particular that demand for mobile broadband services is growing rapidly, and sets a goal of making 500 MHz of additional spectrum available for mobile broadband uses within the next ten years.[2] The NBP proposes several approaches, including improving market transparency, accelerating the process by which government spectrum is brought to market, increasing flexibility in certain bands (e.g., Mobile Satellite Service, or "MSS"), increasing reliance on unlicensed spectrum, and having the FCC conduct "incentive auctions" to facilitate spectrum repurposing (e.g., of spectrum currently allocated to broadcast television). The details of these proposed policies will be defined in rulemaking proceedings that will affect the markets for mobile broadband and other communications services for years, if not decades, to come.

The purpose of this paper is to evaluate the NBP's spectrum policy proposals in the context of the modern spectrum policy consensus. As discussed further below, the key points of the modern consensus include the following: (a) spectrum should be allocated so as to maximize the net economic benefits (public as well as private) flowing from its use;[3] (b)

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1. *See* FCC, CONNECTING AMERICA: THE NATIONAL BROADBAND PLAN (2010), http://download.broadband.gov/plan/national-broadband-plan.pdf [hereinafter NBP]. The NBP was issued in response to a 2009 congressional directive instructing the FCC to develop a plan to ensure that every American has access to broadband capability. It makes recommendations to the FCC, the Executive Branch, Congress, and state and local governments.

2. *Id.* at 75.

3. The phrase "net economic benefits" refers to both the private benefits of a service, which typically are reflected in its market value, and its public benefits (e.g., public safety

spectrum licenses should be flexible with respect to the technologies used and the services provided, subject to the ability to police interference efficiently; (c) spectrum should be tradable, so that spectrum allocations can adjust dynamically to changes in markets and technologies; and, (d) government users should face the opportunity costs associated with spectrum used for public purposes, and have incentives to transfer underutilized spectrum to the private sector.

To be sure, the spectrum reform consensus is neither all-encompassing nor fully complete. For example, the question of how much spectrum should be allocated for exclusive use, as opposed to being managed through an open or "commons" approach, is hotly debated;[4] and, as discussed at length below, there are important unanswered questions about government's proper role in facilitating dynamic spectrum reallocation (i.e., in secondary markets and repurposing).[5]

Upon review, the NBP's spectrum reform proposals track closely with the modern consensus in some areas, especially with respect to the Plan's emphasis on the importance of spectrum flexibility and trading. In other areas, including its embrace of spectrum fees and build-out requirements, it seems to diverge from the consensus approach. In still other respects, including specifically its proposals for an active government role in "market-based" spectrum reallocation, the NBP raises issues around which a consensus has not yet formed.

The remainder of this paper is organized as follows. Section II presents a brief overview of spectrum policy in the United States, including the development of a consensus around the need for market-oriented reforms. Section III details the primary factors that make reform of spectrum policy so urgent, including (as the NBP emphasizes) the growing demand for mobile wireless services and, most recently, mobile broadband. Section IV discusses the NBP's proposals from both a policy and a market perspective. Section V presents a brief conclusion.

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benefits), which typically are not reflected in market valuations. *See, e.g.*, FCC, *Spectrum Analysis: Options for Broadcast Spectrum,* OBI Technical Paper No. 3, June 2010 [hereinafter *OBI Technical Paper*] at 7, http://download.broadband.gov/plan/fcc-omnibus-broadband-initiative-(obi)-technical-paper-spectrum-analysis-options-for-broadband-spect rum.pdf ("When faced with hard choices as to how to allocate limited resources, market valuation is one useful indicator of appropriate resource allocation. Other indicators, such as public benefits to society, are also necessary, particularly when evaluating an asset that is publicly owned.").

4. *See, e.g.*, Thomas W. Hazlett & Evan T. Leo, *The Case for Liberal Spectrum Licenses: A Technical and Economic Perspective*, GEO. MASON UNIV. LAW & ECON. RES. PAPER SERIES 10-19, (March 2010), *available at* http://ssrn.com/abstract=1585469.

5. *See, e.g.*, Philip J. Weiser & Dale Hatfield, *Spectrum Policy Reform and the Next Frontier of Property Rights*, 15 GEO. MASON L. REV. 549, 549 (2008).

II. THE SPECTRUM REFORM CONSENSUS

The spectrum reform movement began with the publication of a little-noticed article by Leo Herzel in 1951.[6] More than fifty years later, it has produced a broad consensus around key principles that should govern spectrum policy. The first section below discusses the development of the spectrum reform consensus, and its impact, thus far, on policy. The second section discusses the limits of the consensus, and the extent to which its policy implications have not yet been adopted.

A. The Spectrum Reform Movement

For most of the twentieth century, the United States pursued a command and control approach to spectrum management. Spectrum licenses were assigned by administrative fiat, and their terms prescribed both the technologies that could be used and the services that could be provided.[7] Licenses could be transferred,[8] but only with the FCC's explicit approval, and generally only in the sizes and for the uses originally dictated by the FCC. Licensees could not disaggregate or partition their licenses into potentially more saleable units. Moreover, most licensees could not lease or share spectrum with third parties.[9] Overall, market forces played little if any role in determining who could use the electromagnetic spectrum or what they could do with it.

Beginning in the late 1950s, the command and control regime came under increasing criticism from academics and policy analysts.[10] In dozens of articles and studies, they demonstrated that the traditional approach was failing to serve the public interest. The process of assigning spectrum by administrative hearings was not only slow and inefficient, but also created

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6. Leo Herzel, "*Public Interest" and the Market in Color Television Regulation*, 18 U. CHI. L. REV. 802 (1951).

7. LAWRENCE J. WHITE, *"Propertyzing" the Electromagnetic Spectrum: Why It's Important, and How to Begin*, *in* COMMUNICATIONS DEREGULATION AND FCC REFORM, 111–44 (Jeffrey A. Eisenach and Randolph J. May, eds., 2001), http://w4.stern.nyu.edu/emplibrary/00_012.PDF.

8. *But see* App'n of Bill Welch for Comm'n Consent to Transfer Control of the Florence, Alabama Non Wireline Cellular Permit to McCaw Commun. of Florence, Inc., *Memorandum Opinion and Order*, 3 F.C.C.R. 6502 (1988) (reversing the FCC's long-held prohibition on for-profit trading of "bare" licenses).

9. *See* Geographic Partitioning and Spectrum Disaggregation by Commercial Mobile Radio Servs. Licensees, *Report and Order and Further Notice of Proposed Rulemaking*, 11 F.C.C.R. 21831, 5 Comm. Reg. (P & F) 634 (1996) [hereinafter *Geographic Partitioning Report*].

10. The seminal contribution was made by Ronald Coase. *See* R.H. Coase, *The Federal Communications Commission*, 2 J.L. & ECON. 1 (1959), *available at* http://www.jstor.org/stable/724927.

opportunities for politically powerful interests to "game" the process for their own benefit.[11] The lack of license flexibility locked licensees into inefficient technologies and prevented them from introducing new services.[12] Prohibitions against leasing or sharing prevented usage rights from getting into the hands of those most able to put them to productive use. Studies showed that the system's failings—most famously, the decades-long delay in the introduction of cellular telephone services—were slowing technological innovation and costing consumers billions of dollars.[13]

Critics of the command and control approach recommended that spectrum policy be modified to incorporate market forces.[14] Under this approach, government, rather than licenses, would create property rights, auction those rights off to the highest bidder, and allow the owners to offer whatever services consumers demanded, so long as they did not cause interference for their spectrum "neighbors."[15] In cases where a pure property rights approach is inappropriate or politically unachievable (e.g., government uses), market-like incentives would be used to the maximum extent possible.[16]

For many years, market-oriented reform proposals were limited to the academic journals. By the 1980s, however, the demand for spectrum to accommodate new wireless technologies, such as cell phones and direct broadcast satellite television, combined with a growing recognition of the inequities and inefficiencies of the current system, led to increasing pressure for reform. Initial efforts were mainly too timid to matter, or—as was the case with the FCC's brief experiment with assigning licenses by

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11. *See, e.g.*, Thomas W. Hazlett, *The Rationality of U.S. Regulation of Broadcast Spectrum*, 33 J. L. & ECON. 133 (1990).

12. *See "Propertyzing" the Magnetic Spectrum*, *supra* note 7. ("The reality of that regulation has been a process in which, all too often, the Federal Communications Commission has discouraged competition, favored incumbents over entrants and innovators, delayed the development of new technologies, and generally mismanaged a scarce resource."). *Id.* at 111.

13. *See, e.g.*, Jerry A. Hausman, *Valuing the Effect of Regulation on New Services in Telecommunications*, 28 BROOKINGS PAPERS ON ECONOMIC ACTIVITY: MICROECONOMICS 1 (1997). For citations to several of the most significant contributions, see Comments of 37 Concerned Economists, In the Matter of Promoting Efficient Use of Spectrum Through Elimination of Barriers to the Development of Secondary Markets, FCC WT Docket No. 00-230 at 4 n. 2 (rel. Feb. 7, 2001) [hereinafter Comments of 37 Concerned Economists].

14. *See, e.g., The Federal Communications Commission*, *supra* note 10.

15. *See "Propertyzing" the Electromagnetic Spectrum*, *supra* note 7.

16. *See, e.g.*, Arthur S. De Vany et al., *A Property System for Market Allocation of the Electromagnetic Spectrum: A Legal-Economic-Engineering Study*, 21 STAN. L. REV. 1499 (1969).

lottery rather than administrative hearings—simply unsuccessful in efficiently assigning spectrum to the highest and best use.[17]

In 1991, the National Telecommunications and Information Administration ("NTIA") undertook a major review of U.S. spectrum policy. The resulting report—*U.S. Spectrum Management Policy: Agenda for the Future*[18]—concluded that the command and control approach should be replaced in favor of greater reliance on markets:

> NTIA believes that, for most purposes, a spectrum management system that provides users with both incentives and opportunities to use spectrum in ways that are economically efficient will produce greater benefits for society than a centrally planned, highly regulatory system that attempts a "top down" approach to managing spectrum use . . . . For most private-sector users, a choice mechanism suggests itself that could be much more efficient than the current system – the market.[19]

Based on this finding, *Agenda for the Future* made a number of specific recommendations, including the following: spectrum should be assigned through the use of competitive bids; licensees should have increased flexibility in the technologies they use and the services they offer; trading, leasing, and sharing of spectrum among licensees should be permitted; and, incentives should be introduced to encourage more efficient use of spectrum by government agencies.[20] In an important sense, *Agenda for the Future* represented the first official embrace of the modern spectrum reform consensus.

The NTIA's recommendations proved to be highly influential, forming the basis for a bipartisan reform effort during the 1990s and early 2000s, under which Congress, the FCC and the NTIA all took steps to interject greater flexibility and reliance on market mechanisms into U.S. spectrum policy. For example, Congress authorized the use of competitive bidding (i.e., auctions) to assign spectrum to new licensees in 1993.[21] The first spectrum auction, the Narrowband PCS auction, was held in July

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17. *See, e.g.*, Thomas W. Hazlett, *Assigning Property Rights to Radio Spectrum Users: Why Did FCC License Auctions Take 67 Years?*, 41 J.L. & ECON. 529, 533 (1998); *see also* Peter Cramton, *The Efficiency of the FCC Spectrum Auctions*, 41 J.L. & ECON. 727, 728 (1998) (explaining that lotteries resulted in fragmented property rights which took time to reassemble into more valuable packages).

18. NAT'L TELECOMMS. & INFO. ADMIN., U.S. SPECTRUM MANAGEMENT POLICY: AGENDA FOR THE FUTURE (1991), *available at* http://www.ntia.doc.gov/report/1998/us-spectrum-management-policy-agenda-future [hereinafter AGENDA FOR THE FUTURE].

19. *Id.* at 86–87.

20. *Id.* at 11–19.

21. Omnibus Budget Reconciliation Act of 1993, Pub. L. No. 103-66, 107 Stat. 312. *See also* FCC, AUCTIONS, http://wireless.fcc.gov/auctions/default.htm?job=about_auctions (last visited Nov. 15, 2011).

1994, generating $617 million in revenues.[22] Between 1994 and 2010, subsequent auctions yielded an additional $77.4 billion in net revenue.[23] Despite some serious missteps, spectrum auctions (in combination with increased spectrum flexibility) have resulted in the more efficient allocation of spectrum,[24] and significantly accelerated the spectrum assignment process relative to comparative hearings.[25]

The FCC moved significantly in the direction of greater license flexibility. For example, unlike the original analog cellular telephone licenses, digital mobile phone licenses (Personal Communications Services, or "PCS" licenses), which the FCC auctioned beginning in the mid-1990s, allowed licensees substantial flexibility in the choice of technology and services offered.[26] At the same time, the FCC granted cellular licensees additional flexibility, including the ability to choose their own digital technology path. Similarly, a licensee for Advanced Wireless Service ("AWS") and 700 MHz spectrum "may provide any services for which its frequency bands are allocated . . . ."[27]

The FCC enabled a more robust secondary market for spectrum by first permitting certain licensees to "disaggregate" and "partition" their licenses,[28] and then later expanding its disaggregation and partitioning

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22. Peter C. Cramton, *Money Out of Thin Air: The Nationwide Narrowband PCS Auction*, 4 J. ECON. & MGMT. STRATEGY 267, 267 (1995), http://www.cramton.umd.edu/papers1995-1999/95jems-money-out-of-thin-air.pdf.

23. *See Auctions Summary*, FCC, http://wireless.fcc.gov/auctions/default.htm?job=auctions_all (last visited Nov. 15, 2011).

24. *See, e.g.*, *Efficiency of FCC Spectrum Auctions*, *supra* note 17; *see also* Arthur DeVany, *Implementing a Market-Based Spectrum Policy*, 41 J.L. & ECON. 627, 629 (1998) ("[A]uctions surely are a better way to issue licenses than the arbitrary ways of the past . . . .").

25. Thomas W. Hazlett, *The Wireless Craze, The Unlimited Bandwidth Myth, The Spectrum Auction Faux Pas, and the Punchline to Ronald Coase's "Big Joke": An Essay on Airwave Allocation Policy* 111–12 (AEI-Brookings Joint Ctr. for Regulatory Studies, Working Paper No. 01-2, 2001), *available at* http://papers.ssrn.com/sol3/papers.cfm?abstract_id=286932.

26. *Id.* at 156–57.

27. 47 C.F.R. § 27.2(a) (2007). Of note, although the FCC intended its Wireless Communications Service ("WCS") licenses to allow for "any fixed, mobile, radio location services, or satellite Digital Audio Radio Services ('satellite DARS')" (quoting Amendment of the Comm'n's Rules to Establish Part 27, the Wireless Comms. Serv. ("WCS"), *Notice of Proposed Rulemaking*, 11 F.C.C.R. 21713, para. 1 (1996) (footnotes omitted)), the technical rules adopted for WCS effectively limited terrestrial operations in this spectrum to fixed operations. On May 20, 2010, the FCC revised the technical rules in order to "enable licensees to provide mobile broadband services in 25 megahertz of the WCS band." Amendment of Part 27 of the Comm'n's Rules to Govern the Operation of Wireless Comms. Serv. in the 2.3 GHz Band*, Report and Order*, 10 F.C.C.R. 82, para. 1 (2010) [hereinafter *WCS/SDARS Order*].

28. *Geographic Partitioning Report*, *supra* note 9.

rules to a wider group of licensees and permitting—under limited conditions—leasing of spectrum among licensees.[29] In addition, in 1998, the FCC embarked on an effort to make information available about existing spectrum licenses—essential to the functioning of efficient markets—on its website through the Universal Licensing System ("ULS").[30]

As part of the Telecommunications Act of 1996, Congress amended § 336 of the Communications Act to accord licensees for Advanced Television Services ("ATV") the right to "offer such ancillary or supplementary services on designated frequencies as may be consistent with the public interest, convenience, and necessity,"[31] so long as the licensee continues to broadcast at least one free standard definition, over-the-air digital television signal.[32] In 1997, the FCC defined "ancillary and supplementary" very broadly, including "subscription television programming, computer software distribution, data transmissions, teletext, interactive services, audio signals, and any other services that do not interfere with the required free service."[33]

These actions were the result of the emergence of a broad consensus around basic principles of spectrum policy. By the turn of the century, it seems clear that policymakers had embraced fully the idea that reliance on markets and competition was preferable to regulation and administrative process. For example, in December 1996, FCC Chairman Reed Hundt

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29. *See* Promoting Efficient Use of Spectrum Through Elimination of Barriers to the Dev. of Secondary Markets, *Notice of Proposed Rulemaking*, 15 F.C.C.R. 24203 (2000); *see also* Promoting Efficient Use of Spectrum Through Elimination of Barriers to the Dev. of Secondary Markets, *Report and Order and Further Notice of Proposed Rulemaking*, 18 F.C.C.R. 20604 (2003).

30. *See* FCC, *About ULS*, http://wireless.fcc.gov/uls/index.htm?job=about (last visited Nov. 15, 2011); *see also* Press Release, FCC, Press Statement of FCC Chairman William E. Kennard (Sept. 17, 1998), *available at* http://transition.fcc.gov/Speeches/Kennard/Statements/stwek870.html; *see also* NBP, *supra* note 1, at 79–80.

31. 47 U.S.C. § 336(a)(2) (2006).

32. § 336(b) (2006); *see also* Advanced TV Sys. and Their Impact upon the Existing TV Brdcst. Serv., *Fifth Report and Order*, 12 F.C.C.R. 14588, para. 32 (1997) [hereinafter Advanced TV].

33. Advanced TV, *supra* note 32, at para. 29. Section 336 also addressed the notion that flexible rights result in incumbent licensees receiving a "windfall." Congress provided that ATV licensees who use their spectrum for ancillary or supplemental services must pay a fee to the U.S. Treasury, set to "recover for the public an amount that, to the extent feasible, equals but does not exceed (over the term of the license) the amount that would have been recovered" had the spectrum been auctioned. 47 U.S.C. § 336(e)(2)(B) (2006) (referencing 47 U.S.C. § 309(j) (2009)). In 1998, the FCC set the fee at five percent of revenues. *See* Fees for Ancillary or Supplementary Use of Digital TV Spectrum Pursuant to Section 336(e)(1) of the Telecomms. Act of 1996, *Report and Order*, 14 F.C.C.R. 3259, 14 Comm. Reg. (P & F) 126 (1998).

announced his agenda for the coming year. With respect to spectrum policy, he said:

> Spectrum should be put to its most valued use. The Commission should trust markets to assure this result, although we should act as the 'register of deeds' for spectrum licenses—maintaining information as to which firms hold what licenses. Auctions allow markets to determine who will use the spectrum. We should also rely on markets to determine how the spectrum will be used. The Commission should move away from the old top-down, central planning approach of the past towards a decentralized approach that allows the spectrum licensee, rather than the government, to determine how spectrum will be used."[34]

Under Chairman Kennard, the FCC repeatedly reaffirmed its support for a market-based approach. The Chairman's August 1999 Strategic Plan, for example, concluded that the FCC should "[r]ely principally on the marketplace to achieve the highest value use of spectrum."[35] Similarly, the FCC's November 1999 *Spectrum Policy Statement* found that "[f]lexible allocations may result in more efficient spectrum markets . . . ."[36] A position it reiterated in its November 2000 *Policy Statement on Secondary Markets*, which concluded that "[l]icensees/users should have flexibility in determining the services to be provided and the technology used for operation consistent with the other policies and rules governing the service."[37]

In October 2003, the FCC revised its secondary market spectrum rules, enabling the lease of spectrum usage rights, and continuing the FCC's "evolution toward greater reliance on the marketplace to expand the scope of available wireless services and devices, leading to more efficient and dynamic use of the important spectrum resource to the ultimate benefit of consumers throughout the country."[38]

Other policy statements, including the 2002 Report of the FCC's Spectrum Policy Task Force[39] and NTIA's 2004 Spectrum Initiative

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34. Reed E. Hundt, Chairman, Fed. Comm. Comm'n, The Hard Road Ahead—An Agenda for the FCC in 1997 (Dec. 26, 1996), *available at* http://www.fcc.gov/Speeches/Hundt/97agenda.txt.

35. FCC, STRATEGIC PLAN: A NEW FCC FOR THE 21ST CENTURY 20 (1999), http://transition.fcc.gov/21st_century/draft_strategic_plan.pdf.

36. Principles for Reallocation of Spectrum to Encourage the Dev. of Telecomms. Techs. for the New Millennium, *Policy Statement*, 14 F.C.C.R. 19868, para. 9 (1999).

37. Principles for Promoting the Efficient Use of Spectrum by Encouraging the Dev. of Secondary Markets, *Policy Statement*, 15 F.C.C.R. 24178, para. 20 (2000).

38. Promoting Efficient Use of Spectrum Through Elimination of Barriers to the Dev. of Secondary Markets, *Report and Order and Further Notice of Proposed Rulemaking*, 18 F.C.C.R. 20604, para. 2 (2003).

39. FCC, SPECTRUM POLICY TASK FORCE REPORT 16 (2002) [hereinafter SPTF REPORT]

report,[40] reached similar conclusions. As discussed at length below, the National Broadband Plan embraces—at least in the broadest sense—these same market-oriented principles; indeed, Chairman Genachowski has made a point of emphasizing spectrum flexibility and secondary markets in speeches and testimony.[41]

To summarize, the modern consensus on spectrum reform consists of at least the following four main elements. First, the primary goal of spectrum policy should be to assure that spectrum is allocated to its highest value use, defined broadly in terms of economic welfare.[42] Second, spectrum allocations and usage rights should be defined as broadly (or "flexibly") as possible so as to allow spectrum to be "repurposed" or "reallocated" with a minimum of administrative process. Third, market mechanisms, including auctions (for initial assignment of licenses) and secondary markets (for redistribution among licensees), are the preferred method of assigning spectrum rights to parties. Fourth, and in keeping with the principle of putting spectrum to its highest value use, government

("As a general proposition, flexibility in spectrum regulation is critical to improving access to spectrum. In this context, 'flexibility' means granting both licensed users and unlicensed device operators the maximum possible autonomy to determine the highest valued use of their spectrum, subject only to those rules that are necessary to afford reasonable opportunities for access by other spectrum users and to prevent or limit interference among multiple spectrum uses.").

40. US DEPT. OF COMMERCE, SPECTRUM POLICY FOR THE 21ST CENTURY 21 (2006), http://www.ntia.doc.gov/files/ntia/publications/implementationplan2006.pdf [hereinafter SPECTRUM POLICY INITIATIVE PLAN] ("The FCC has adopted economic mechanisms of various types in recent years, such as competitive bidding, increased license flexibility, and some use of secondary markets. These tools, when applied appropriately, promote efficient and effective allocation of spectrum.").

41. *See, e.g.*, Julius Genachowski, Chairman, Fed. Comm. Comm'n, Remarks at NAB Show 2010 (Apr. 13, 2010), http://hraunfoss.fcc.gov/edocs_public/ attachmatch/DOC-297469A1.pdf.

42. The term "economic welfare" is interchangeable with "economic efficiency." In the context of spectrum policy, however, "efficiency" can have multiple meanings. For example, the FCC's Spectrum Policy Task Force identified three definitions of efficiency, "spectrum efficiency," "technical efficiency," and "economic efficiency," and noted that the first two are subsumed within the third. *See* SPTF REPORT, *supra* note 39, at 21. ("The Task Force identified three variations on and definitions for the term "efficiency," as applicable to spectrum management: spectrum efficiency, technical efficiency, and economic efficiency. Spectrum efficiency occurs when the maximum amount of information is transmitted within the least amount of spectrum. Technical efficiency occurs when inputs, such as spectrum, equipment, capital, and labor, are deployed in a manner that generates the most output for the least cost. Economic efficiency occurs when all inputs are deployed in a manner that generates the most value for consumers. The Task Force found that spectrum and technical efficiency are components of economic efficiency, but that measuring spectrum and technical efficiency does not necessarily provide any meaningful information with respect to economic efficiency.").

agencies should face incentives to use spectrum economically, and government should release underutilized spectrum into the market.[43]

B. The Limits of the Modern Consensus

While the emergence of a consensus around market principles is extremely significant, the consensus also has limits. As a result, and despite the substantial progress detailed above, spectrum policy reform remains a work in progress.

Implementation of the spectrum policy consensus has been slowed by at least four factors. First, the consensus simply does not extend to some significant policy issues, most notably the question of how much spectrum should be "unlicensed" and hence treated as a "commons."[44]

Second, while most would agree with the principle of maximizing economic welfare, significant disagreements remain over how (or even whether) to value such "public interest" goals as public safety or maintaining a diversity of voices on the airwaves, as well as how those goals should be pursued.

Third, even in the significant areas where there is agreement on principle, the agreed-upon principles do not fully address important practical questions of implementation. What, if anything, should government do (beyond simply creating tradable rights) to facilitate the workings of secondary markets? To what extent does granting flexibility generate inequitable "windfalls" for incumbents, and what is the appropriate policy response? What is the best way to define and police interference? How can government agencies be faced with meaningful incentives for efficient spectrum utilization? The list, of course, goes on.

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43. The consensus extends outside the United States, and several countries, including Australia, Guatemala, and the United Kingdom, have led the United States in adopting liberalized regimes. For a concise summary, see Thomas W. Hazlett, *Property Rights and Wireless License Values*, 51 J.L. & ECON. 563, Appendix A (2008). *See also* MARTIN CAVE, REFORMING UK SPECTRUM POLICY (2002), http://intel.si.umich.edu/tprc/papers/2002/40/mec854.htm ("For trading to bring consumer benefits, then firms must have some freedoms to combine spectrum with other inputs in innovative ways. Ofcom will therefore need to move further than the RA has in defining a generic set of rights and responsibilities for the holder of a spectrum licence. Boundaries of licences will, as ever, need to be carefully defined to help manage interference. But within such boundaries, and subject to any international harmonization constraints, licensees should be as free as possible to determine the wireless service they provide and the technology they choose to deploy.").

44. Even this contentious issue may be converging towards some sort of compromise. *See, e.g.*, Pietro Crocioni, *Is Allowing Trading Enough? Making Secondary Markets in Spectrum Work*, 33 TELECOMM. POL'Y 451, 452 (2009) ("While the debate has often been portrayed as a clash of two opposing views, in practice, there are examples where a compromise solution has been chosen. Indeed, this has led a number of economists to take intermediate positions where the two approaches can coexist.").

Fourth, and finally, there is the political reality that choices about spectrum policy inescapably involve the political distribution (or redistribution) of wealth among competing interests. Thus, even welfare-enhancing policy changes are subject to opposition by potential "losers," and even the most mundane implementation details may be controversial if they affect the distribution of gains and losses.[45]

These factors have slowed the translation of the spectrum reform consensus into actual policy. Indeed, in practice, spectrum policy has continued for the most part to reflect the command and control legacy of the last century. Most spectrum rights are still defined narrowly, prescribing the technology that must be employed, the services that must be offered, or both.[46] As former FCC Chairman Reed Hundt put it in 2005:

> As discussed in virtually all FCC statements, but only put into practice in certain circumstances, the FCC should not place artificial use restrictions on the licensees. Licensees should be allowed to compete to provide whatever service they think will serve consumers [sic] demand provided that they do not cause undue interference to other spectrum users.[47]

Similarly, in 2008, Philip Weiser concluded that "the momentum of [the spectrum reform] initiative, which built on earlier spectrum policy reform efforts, was short lived . . . ."[48] Thus, despite the creation of limited spectrum trading rights, billions (perhaps tens of billions) of dollars' worth of spectrum remain locked in inefficient or obsolete uses.[49] In the face of surging demand for spectrum-based services, spectrum remains both expensive and difficult to acquire. More than fifty years after academics first proposed market-oriented reforms, and nearly twenty years after the

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45. *See, e.g.*, Thomas W. Hazlett, *The Rationality of U.S. Regulation of the Broadcast Spectrum*, 33 J.L. & ECON. 133 (1990).

46. *See* Evan Kwerel & John Williams, *A Proposal for a Rapid Transition to Mkt. Allocation of Spectrum* 1 (FCC OPP, Working Paper No. 38, 2002) (estimating that "only about seven percent of the most valuable spectrum (in 300MHz – 3,000 MHz range) is available for market allocation, *i.e.*, is flexibly allocated and exclusively and exhaustively licensed."). For a more recent estimate, see Thomas W. Hazlett, David Porter, & Vernon Smith, *Radio Spectrum and the Disruptive Clarity of Ronald Coase* 30 n. 147 (Geo. Mason L. & Econ. Research Paper Series, Working Paper 10–18), http://www.law.gmu.edu/assets/files/publications/working_papers/1018RadioSpectrum20100325.pdf (estimating less than twelve percent of U.S. spectrum under 3.5 GHz is subject to spectrum flexibility).

47. Reed E. Hundt & Gregory L. Rosston, *Comms Policy for 2005 and Beyond* 9 (Stanford Inst. for Econ. Policy Research, Discussion Paper No. 04-07, 2005).

48. Phillip Weiser, *The Untapped Promise of Wireless Spectrum* 9 (The Hamilton Project, Discussion Paper No. 2008-08, 2008), *available at* http://www.brookings.edu/papers/2008/07_wireless_weiser.aspx.

49. *Id.*

government first endorsed them, the reform agenda has been, at best, only partially implemented.

In this context, the renewed focus on spectrum policy in the National Broadband Plan constitutes a potentially important turning point. As the Plan makes clear, "the failure to revisit historical allocations can leave spectrum handcuffed to particular use cases and outmoded services, and less valuable and less transferable to innovators who seek to use it for new services."[50] Moreover, as discussed in the following section, the costs of such ossification increase as both the value of the spectrum and the pace of market and technological change increase. On the surface, at least, there seems to be good reason to believe that the pace of spectrum reform also is poised to accelerate.

III. THE RISING COSTS OF SPECTRUM INFLEXIBILITY

As technologies advance and markets grow, the costs of command and control regulation of spectrum grow as well. Technological progress is constantly creating new services and increasing the efficiency with which it is possible to provide existing ones, leading, in turn, to rapid growth in demand for wireless services of all kinds. Spectrum is an essential input to all wireless services, and policies that prevent that input from being used efficiently act as an artificial restraint on both technological progress and economic growth.

Even the partial reforms enacted since NTIA's seminal report in 1991 have generated tremendous benefits for consumers and the economy and, equally importantly, have created powerful incentives for both market and technological innovation. However, as much as policy has evolved, markets and technologies have changed even more rapidly. In 1991, virtually all wireless communications were analog. Cell phones did not receive emails or transmit video (let alone play music or access the nonexistent Internet); four of ten Americans still received their television signals from terrestrial antennas;[51] direct-broadcast satellite TV was just getting off the ground; HD television (and digital radio) were still on the drawing board; and Wi-Fi and Wi-Max were, at most, futurist dreams. Today, new wireless technologies and applications are emerging at an ever-increasing pace, and consumer demand for mobile broadband and other wireless services is exploding.

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50. NBP, *supra* note 1, at 78–79.

51. *See* Annual Assessment of the Status of Competition in Mkts. for the Delivery of Video Programming, *Fourth Annual Report*, 13 F.C.C.R. 1034, 1174 tbl. B-1 (1998) (showing only fifty-eight percent of U.S. TV households subscribing to cable).

The NBP bluntly acknowledges both the nature of the problem and the urgency of reform. The Plan acknowledges that "[t]he current spectrum policy framework"—which includes legacy command and control rules, high transaction costs, and highly fragmented license regimes—"sometimes impedes the free flow of spectrum to its most highly valued uses."[52] It calls for making more spectrum available, affording licensees greater flexibility to use their spectrum, and creating new models to access spectrum.[53] Without such reforms, the Plan warns that "[t]he growth of wireless broadband will be constrained," resulting in "higher prices, poor service quality, an inability for the U.S. to compete internationally, depressed demand and, ultimately, a drag on innovation."[54]

The NBP is correct in its assessment that mobile wireless services have grown rapidly in the past and are likely to continue growing in the future, especially if, as the Plan suggests, such services come to compete effectively with fixed broadband services for a significant proportion of the market.[55] There is little doubt that this growth will lead to increased spectrum requirements.[56] At the same time, and as discussed further below, the NBP itself acknowledges that spectrum demand is difficult to forecast. What is unambiguously true, and essentially important, is that the demand for spectrum is changing—qualitatively as well as quantitatively—at an

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52. NBP, *supra* note 1, at 78–79.

53. *See id*. at 77–79, 84–94.

54. *Id*. at 77. These concerns echo similar warnings issued over the past two decades. For example, the Agenda for the Future Report concluded that "[c]urrent spectrum management policies . . . are under increasing strain as the demand for existing spectrum-based services grows, and new spectrum-related technologies and applications emerge." AGENDA FOR THE FUTURE, *supra* note 18, at 10. Things had not changed much thirteen years later, when the Spectrum Policy Initiative Plan (issued in June 2004) concluded that "[c]urrent spectrum management policies are under increasing strain as the demand for existing spectrum-based services grows and new spectrum related technologies and applications emerge." SPECTRUM POLICY INITIATIVE PLAN, *supra* note 40, at 2.

55. *See* NBP, *supra* note 1, at 41 ("The ongoing upgrade of the wireless infrastructure is promising because of its potential to be a closer competitor to wireline broadband, especially at lower speeds.").

56. *See id.* at 75; *see also* Cisco, CISCO VISUAL NETWORKING INDEX: GLOBAL MOBILE DATA TRAFFIC FORECAST UPDATE, 2010–2015 1 (Feb. 1, 2011), http://www.cisco.com/en/US/solutions/collateral/ns341/ns525/ns537/ns705/ns827/white_paper_c11-520862.pdf [hereinafter CISCO FORECAST]; Comments of Alcatel-Lucent, Preserving the Open Internet, FCC GN Dkt. No. 09-191 app. (rel. Jan. 14, 2010) (analyzing the impact of traffic growth on the evolution of Internet access); RYSAVY RESEARCH, MOBILE BROADBAND SPECTRUM DEMAND 3 (2008), http://www.rysavy.com/Articles/2008_12_Rysavy_Spectrum_Demand_.pdf; Comments of Verizon Wireless at 18, 73–74 n.241, 77–78, Implementation of Sec. 6002(b) of the Omnibus Budget Reconciliation Act of 1993, FCC WT Dkt. No. 09-66, (rel. Sept. 30, 2009); Comments of Verizon Wireless at 42–43, 143, Fostering Innovation and Inv. in the Wireless Commun. Mkt., FCC GN Dkt. No. 09–157, (rel. Sep. 30, 2009) [hereinafter Verizon Comments].

accelerating pace. That is, spectrum demand is becoming more *volatile* over time, thereby increasing the costs of a system that frustrates and delays dynamic reallocation. As explained below, the two primary factors behind the accelerating pace of change are: (a) the growing demand for spectrum-based services, including mobile broadband; and (b) the rapid pace of change in wireless (and related) technologies.

A. The Growing Demand for Wireless Services

The supply of spectrum, strictly speaking, is fixed. While technology can (as discussed below) increase the efficiency with which spectrum is used, and even make previously "unusable" spectrum usable, at the end of the day there are only so many frequencies on the electromagnetic spectrum. Furthermore, certain frequencies are, by their nature, better suited to certain applications than others. With current technologies, spectrum in the 300–3000 MHz range is vastly more valuable for most applications than spectrum in either higher or lower frequencies.[57]

In economic terms, spectrum "scarcity" ideally would be measured by its price. Unfortunately, spectrum is anything but fungible. Its value depends on a wide variety of factors, including: the size, shape, and population characteristics (i.e., density) of the geographic area covered; the propagation characteristics of the particular band; the interference environment; and—in the current world of tightly-prescribed usage rights for most spectrum licenses—the precise license conditions that determine how the spectrum can be used. These factors make it difficult to compare prices both across spectrum blocks (e.g., between auctions) and over time.

That said, the rapid growth of spectrum demand has consistently outstripped both public and private projections, and there is a general consensus that demand has increased more rapidly than supply[58]—i.e., that spectrum has become more, not less, scarce.[59] In absolute terms, at least,

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57. *See* Kwerel & Williams, *supra* note 46.

58. *See* SPTF REPORT, *supra* note 39, at 12 ("Historically, both industry and Commission projections for spectrum use have significantly and consistently underestimated the need for additional spectrum and the public's utilization of new technologies and applications. One illustrative example is the explosive growth in consumer demand for mobile wireless services. In 1994, the Commission allocated spectrum based on a projection of 54 million domestic mobile services users for the year 2000. By the year 2000, however, there actually were approximately 110 million mobile services users."). *See also* J.H. Snider, *An Explanation of the Citizens' Guide to the Airwaves,* NEW AMERICA FOUNDATION 30 (2003), www.newamerica.net/files/airwaves.pdf ("[The d]emand for [s]pectrum [i]s [s]urging . . . . Over the last hundred years, the demand for spectrum, like the supply of spectrum, has skyrocketed. No matter how much new supply of spectrum comes on the market, demand seems to increase faster.").

59. *See* NBP, *supra* note 1, at 84 (noting that "virtually all the major players in the

there is no doubt that wireless spectrum continues to be expensive. For example, in October 2007, AT&T acquired 12 MHz of 700 MHz spectrum covering 196 million Americans (including 72 of the top 100 U.S. markets) for $2.5 billion.[60] The original bidders (including the seller, Aloha Partners, and two firms it subsequently acquired, had purchased the spectrum in 2001 and 2003 for approximately $45 million.[61] In early 2008, the FCC's 700 MHz auction generated $19.6 billion in revenue, nearly double prior estimates and the highest amount for any U.S. spectrum auction.[62] These high prices are a function, at least in part, of the artificial scarcity caused by current spectrum policy.[63]

Looking forward, there is every reason to believe demand will continue to grow.[64] Perhaps the greatest single driver of rising spectrum

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wireless industry have stated on the record that more spectrum is needed. Estimates range from 40 to 150 megahertz *per operator*.") (footnotes omitted). *See also* SPTF REPORT, *supra* note 39, at 14 ("Due to the growth in demand for spectrum-based services, many spectrum users seek additional spectrum and it now appears as though spectrum demand is outstripping spectrum supply.").

60. *See* Implementation of Section 6002(b) of the Omnibus Budget Reconciliation Act of 1993, Annual Report and Analysis of Competitive Market Conditions with Respect to Commercial Mobile Services, *Thirteenth Report*, 24 F.C.C.R. 6185, para. 55 (2009).

61. Aloha's spectrum was auctioned by the FCC in Auctions 44 and 49 and included spectrum originally won in those actions by Aloha, Cavalier Group, LLC, and Datacom Wireless, LLC, for a total of $46,668,120. *See* FCC, LOWER 700 MHZ BAND AUCTION ROUND RESULTS, HIGH BIDS, Auction ID: 44, (Sept. 18, 2002, 3:04 PM), http://hraunfoss.fcc.gov/edocs_public/attachmatch/DA-02-2323A2.pdf; FCC, LOWER 700 MHZ BAND AUCTION ROUND RESULTS, HIGH BIDS, AUCTION ID: 49 (June 16, 2003, 9:56 AM), http://hraunfoss.fcc.gov/edocs_public/attachmatch/DA-03-1978A2.pdf. The latter two firms were subsequently acquired by Aloha. *Aloha Partners Expands 700 MHz Nationwide Presence with Two Acquisitions*, PR NEWSWIRE, http://www.prnewswire.com/news-releases/aloha-partners-expands-700-mhz-nationwide-presence-with-two-acquisitions-54014367.html (last visited November 15, 2011). At the time it was acquired, much of Aloha's spectrum was being used by UHF television broadcasters. Moreover, Congress had not yet set a "date certain" for the DTV transition, which required broadcasters to clear this spectrum. *See* Implementation of Section 6002(b) of the Omnibus Budget Reconciliation Act of 1993, Annual Report and Analysis of Competitive Market Conditions with Respect to Commercial Mobile Services, *Ninth Report*, 19 F.C.C.R. 20597, paras. 94–98 (2004), http://hraunfoss.fcc.gov/edocs_public/attachmatch/FCC-04-216A1.pdf. Thus, the relatively low price paid by Aloha is explained to some extent by the fact that the licenses were encumbered at the time of the 2001 and 2003 auctions and the associated uncertainty about when the bands would be cleared. *See OBI Technical Paper*, *supra* note 3, at 25–26 ("For example, Auctions 44, 49 and 60 of licenses in the 700 MHz band generated proceeds of $0.03–0.05 per megahertz-pop in 2002, 2003 and 2005, respectively—low valuations driven primarily by uncertainty over timing and cost to clear incumbent broadcast TV licensees in that band.").

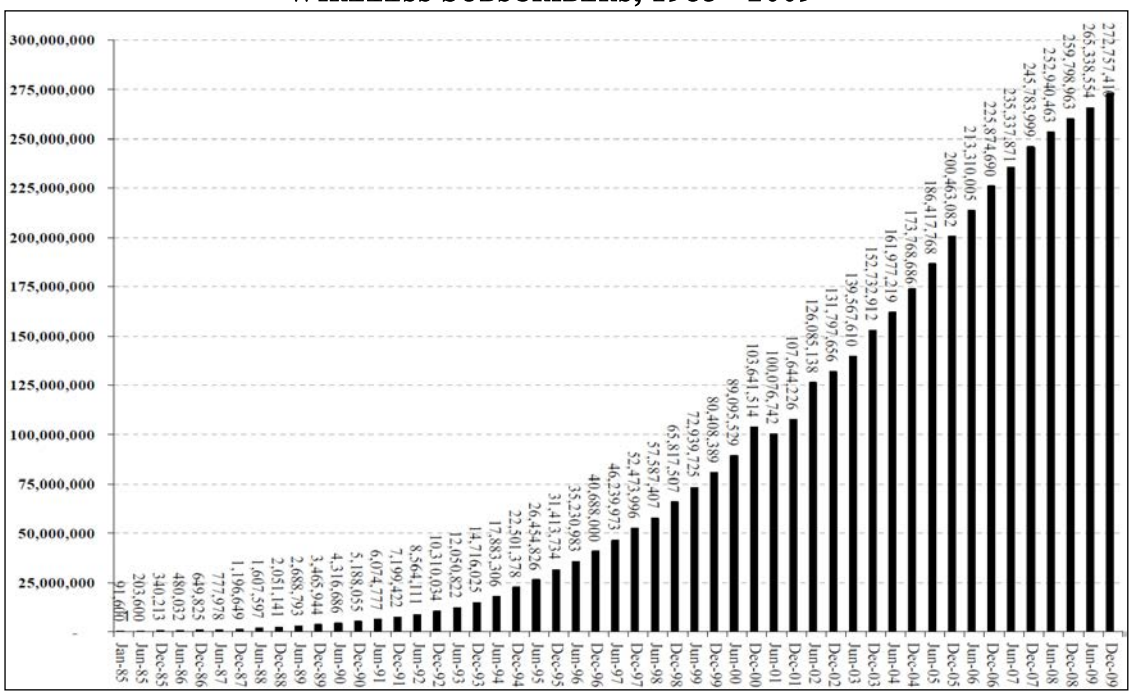
62. *See* Statement by Kevin Martin, Chairman, FCC (March 20, 2008), http://hraunfoss.fcc.gov/edocs_public/attachmatch/DOC-280968A1.pdf.

63. Weiser & Hatfield, *supra* note 5, at 549 ("The scarcity of wireless spectrum reflects a costly failure of regulation.").

64. *See* NBP, *supra* note 1, at 85 ("[T]he accelerating nature of industry analyst demand

demand has come from mobile wireless radio, first through the growth of mobile telephony and, more recently, mobile data. Figure 1 shows the increase in the number of cell phone subscribers in the United States since January 1985. While growth has slowed somewhat as penetration approaches the saturation level—subscribership in the past decade grew by "only" 239 percent, compared with 2,200 percent between 1989 and 1999—total subscribership continues to expand.

FIGURE 1:
WIRELESS SUBSCRIBERS, 1985 - 2009[65]



For most of the past decade, wireless voice *usage* grew even faster than subscribership. Between 1999 and 2009, for example, total annual voice minutes of use grew from 148 billion to 2.2 trillion, or more than 1,400 percent. In recent years, however, growth in voice traffic has slowed, with growth averaging only about 3.5 percent annually in 2008 and 2009, and actually declining in the last six months of 2009.[66]

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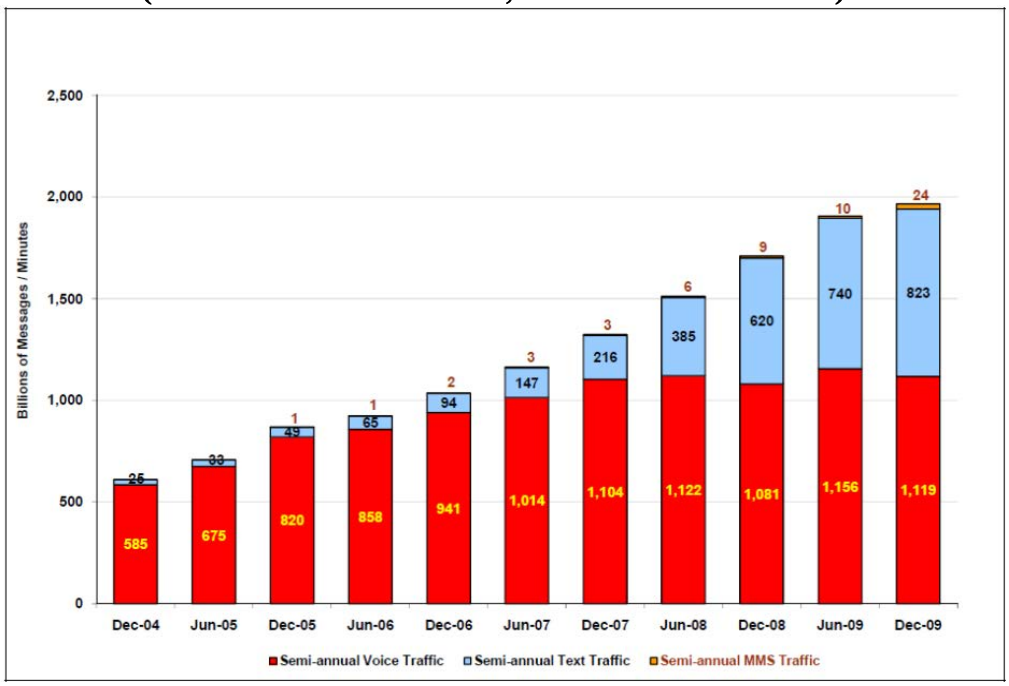
forecasts makes clear that it is not a question of *if* the U.S. will require 300 megahertz of spectrum for mobile broadband, but *when*.").

65. ROBERT F. ROCHE & LESLEY O'NEILL, CTIA'S WIRELESS INDUSTRY INDICES: SEMI-ANNUAL DATA SURVEY RESULTS: A COMPREHENSIVE REPORT FROM CTIA ANALYZING THE U.S. WIRELESS INDUSTRY 21 (2010) [hereinafter CTIA SURVEY].

66. *Id.* at 197–98.

The leveling out of voice usage has been more than matched by increased data usage, including text (SMS) and multimedia (MMS) messaging. As shown in Figure 2 below, the volume of SMS messages rose from 25 billion in the second half of 2004 to 823 billion in the second half of 2009, an increase of 3,100 percent—not including an additional 24 billion MMS messages.

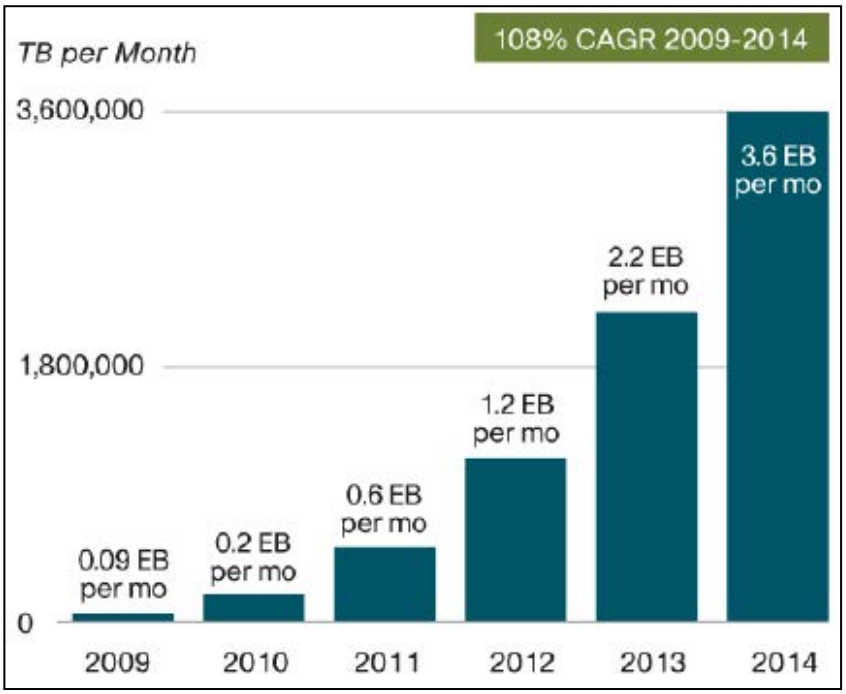
FIGURE 2:
WIRELESS MOUS AND MESSAGES
(SEMI-ANNUAL VOLUMES, JUNE 2005-JUNE 2009)[67]



Looking ahead, analysts expect mobile data traffic to continue growing. Overall, "mobile data traffic increased 160 percent from calendar year-end 2008 to calendar year-end 2009,"[68] and Cisco projects that mobile data traffic will double every year through 2014 at a compound annual growth rate ("CAGR") of 108 percent, as depicted in Figure 3.

67. *Id.* at 213.
68. CISCO FORECAST, *supra* note 56, at 1.

FIGURE 3:
WIRELESS DATA GROWTH FORECAST[69]



Growing demand for spectrum is not limited to mobile broadband, or even to the private sector. For example, Congress has recognized public safety's spectrum needs by dedicating 24 MHz of the 700 MHz band for public safety purposes.[70] The FCC allocated an additional 50 MHz in the 4.9 GHz band, as well as reconfiguring the 800 MHz band to eliminate interference to public safety and provide more efficient spectrum assignments.[71]

One unsurprising result of increasing spectrum demand is to raise the economic welfare costs of inflexibility, as illustrated in Figure 4 below. The Figure shows two supply curves, S^F and S^C, where S^F represents the supply of spectrum in a world with full spectrum flexibility while S^C represents supply when spectrum flexibility is constrained. While the two curves intersect near the origin, they grow further apart as quantity

69. *Id.* at 2; *see also* Comments of CTIA-The Wireless Association at 3–4, A National Broadband Plan for our Future, FCC GN Dkt. No. 09-51 (rel. Oct. 23, 2009).

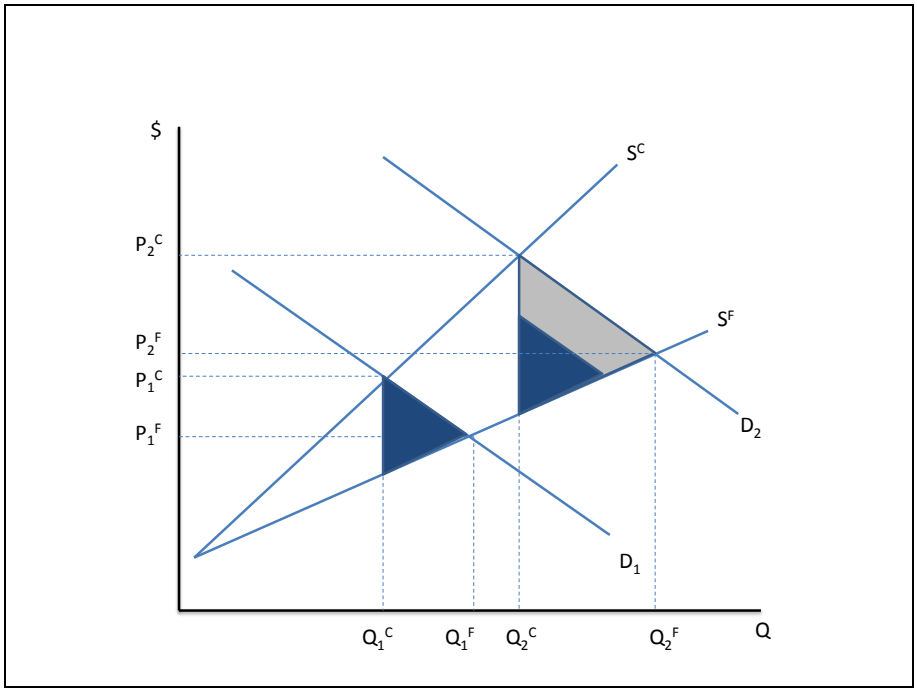
70. *See generally* Implementing a Nationwide, Broadband, Interoperable Public Safety Network in the 700 MHz Band; Dev. of Operational, Technical and Spectrum Requirements for Meeting Federal, State and Local Public Safety Commun. Requirements Through the Year 2010, *Ninth Notice of Proposed Rulemaking*, 21 F.C.C.R. 14837 (2006).

71. *Id.*

increases—representing the fact that, over any particular period of time, the supply response to increased demand will be greater under spectrum flexibility than when flexibility is constrained. (In economic terms, the two curves depict the fact that supply is, by definition, more "elastic" under flexibility.) When growth in demand is relatively small (e.g., from D_0 to D_1), the welfare loss resulting from constrained supply is also relatively small, as indicated by the smaller, dark-shaded triangle.[72]

The effect of inflexibility at higher levels of demand growth is shown by the effects of shifting demand to D_2, and the welfare loss associated with inflexibility in this larger market is shown by the larger, "two-toned" triangle—the darker portion of which shows the welfare loss in the less dynamic market, with the lighter portion representing the increased welfare loss as the market grows.

FIGURE 4:
IMPACT OF GROWING SPECTRUM DEMAND ON WELFARE LOSSES FROM INFLEXIBILITY



72. Under full flexibility, the price would be P_1^F and quantity would be Q_1^F. Under constrained flexibility, price is higher at P_1^C and quantity is lower at Q_1^C. The dark-shaded triangle represents the lost consumer and producer surplus (the area below the demand curve and above the supply curve) as a result of constrained flexibility.

The upshot is straightforward: whatever the costs have been in the past of keeping spectrum locked up in inefficient uses, those costs will grow as the demand for spectrum increases. That is, the costs of spectrum inflexibility are both high and rising.

B. The Effects of Innovation and Market Dynamism

While the development of new technologies has increased the value of wireless communications services and hence increased the demand for spectrum, technology is also making it possible to use spectrum more efficiently. This allows more information to be transmitted over the same amount of spectrum, or even allows spectrum previously thought to be "unusable" to be put to productive use.[73]

Resources expended in pursuit of more efficient spectrum use, whether in the form of research and development or deployment of more spectrum-efficient infrastructures, are not free. Thus, to the extent government policies have the effect of creating artificial scarcity, the market response is to *overinvest* in spectrum efficiency—i.e., to devote resources to economizing on spectrum which could better be devoted to creating new products and services, or to lowering prices. At the same time, however, government policies can inefficiently *retard* the development of new technologies, for example by locking spectrum licensees into inefficient technologies, failing to provide incentives for least-cost solutions to spectrum interference problems, or imposing delays and higher costs on new entrants.

Based on my analysis, I believe technological advances that increase the effective supply of spectrum fall generally into four categories: spectrum reuse, e.g., through the use of ever smaller cell sizes; the ability to use higher bands (shorter wavelengths), thus expanding the range of usable spectrum; use of improved hardware and software (e.g., digital signal

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73. As discussed further below, advances in radio communications technology generally, and in spread spectrum and cognitive (or "smart") radio technologies in particular, have led some academics to argue that the "era of spectrum scarcity is at an end." *See, e.g.,* Michael Calabrese, *The End of Spectrum 'Scarcity': Building on the TV Bands Database to Access Unused Public Airwaves*, New America Foundation, Working Paper No. 25, 2009), http://www.newamerica.net/files/Calabrese_WorkingPaper25_End SpectrumScarcity.pdf. Such predictions may (or may not) prove accurate—at some point in the unforeseeable future. The available evidence is that technology can contribute dramatically to spectrum efficiency (just as more fuel efficient cars can contribute to reducing energy use), but not replace the need for policies that provide incentives for efficient spectrum use, i.e., for further implementation of market-oriented reforms. The question, after all, is not *whether* new technologies should be put to work to increase the effective supply of spectrum, but *how*. Advances in technology clearly have the potential to increase the efficiency with which spectrum is used, and policies need to be put in place to allow (and provide the proper incentives) for these efficiencies to be realized.

processing) to carry more data within a given spectrum block; and use of spread spectrum, software defined radio ("SDR") and cognitive (or "smart") radio technologies to permit multiple users to operate within a given block of spectrum without causing harmful interference.

First, perhaps the most important innovation for purposes of overall spectral efficiency has been the rapid advance in cellular technology that has made possible dramatically higher rates of spectrum efficiency through, for example, more intensive frequency reuse, improved directional antenna technologies, and increased use of cell splitting, thus dramatically increasing the capacity of these systems for any given amount of spectrum.[74]

Second, technological progress has made it possible to utilize ever higher bands of the electromagnetic spectrum. Since the 1920s, when it was thought the usable spectrum extended only to 3 MHz, technology has now progressed to the point where communications are possible in bands as high as 300 GHz,[75] and the FCC has licensed spectrum in bands as high as 95 GHz band for a variety of applications, including point-to-point and point-to-multipoint broadband communications.[76] Even with better technology, however, very high frequency spectrum is useful for only limited applications, due to the inability of high frequency transmissions to penetrate buildings (or even clouds), and other propagation characteristics.

Third, advances in hardware and software, such as more discriminating antennas and digital signal processing algorithms, can increase the data rate or throughput of a given service or device within a given block of spectrum. Digital technologies allow for the use of digital signal processing and other techniques, which can effectively increase the signal-to-noise ratio for any given transmission and thus result in more efficient spectrum use.[77] This increases, for example, the channel capacity of direct broadcast satellite television while simultaneously improving signal quality;[78] dramatically improving the spectral efficiency of

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74. *See*, *e.g.*, Verizon Comments, *supra* note 56, at 94–96.

75. *See Wireless Craze*, *supra* note 25, at 35–39.

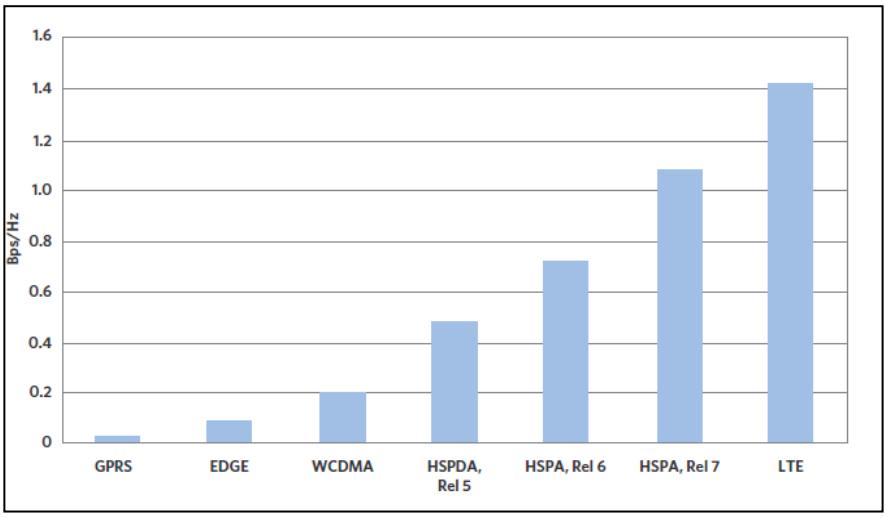
76. *See* Allocations and Service Rules for the 71–76 GHz, 81–86 GHz and 92–95 GHz Bands, *Notice of Proposed Rulemaking*, 17 F.C.C.R. 12182 (2002).

77. *See* SPTF REPORT, *supra* note 39, at 14.

78. *See, e.g.*, Joslyn Read, Commercial Users, Address at Improving Spectrum Management through Economic or Other Incentives: A Workshop 167 (Mar. 1, 2006), *available at* http://www.ntia.doc.gov/files/ntia/publications/spectrumworkshop_030106.pdf. For a summary of recent advances in DBS technologies, see *Testimony Before the Comm. on Energy and Commerce Subcomm. on Commun., Tech. and the Internet U.S. H.R.: Hearing on the National Broadband Plan: Deploying Quality Broadband Services to the Last Mile*, 111th Cong. (2010) (Statement of Mark Dankberg, Chairman and CEO, ViaSat, Inc., http://democrats.energycommerce.house.gov/Press_111/20100421/Dankberg

television broadcasting; and, as shown in Figure 5 below, increasing by a factor of forty or more the spectral efficiency of mobile data standards in approximately a decade.[79]

FIGURE 5:
SPECTRAL EFFICIENCY OF SUCCESSIVE MOBILE DATA STANDARDS[80]



Fourth, and relatedly, spread spectrum and smart radio technologies can—at least in principle—allow multiple signals to use the same blocks of spectrum simultaneously without causing harmful interference.[81] Spread spectrum technology is not new; indeed, the idea dates to patents filed by Nicola Tesla in 1900, and primitive spread spectrum systems have been in use since at least World War II. More recent uses include cordless home telephone systems, Bluetooth, Wi-Fi, and Wi-Max. While spread spectrum systems are often associated with "unlicensed" spectrum (e.g., Wi-Fi), these technologies have seen their most widespread deployment in CDMA 2G and 3G mobile wireless networks.[82]

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79. NBP, *supra* note 1, at 41.

80. *Id.* exhibit 4-F.

81. *See id.* at 95 ("Public comment has suggested that 'opportunistic' or 'cognitive' technologies can significantly increase the efficiency of spectrum utilization by enabling radios to access and share available spectrum dynamically. These technologies could allow access to many different frequencies across the spectrum chart that may not be in use at a specific place and time and could do so without harming other users' operations or interests. Given the upside potential of these technologies, the FCC and NTIA should take steps to expand the environment in which new, opportunistic technologies can be developed and improved.") (citations omitted).

82. *See* Verizon Comments, *supra* note 56, at 95 n.277.

Technological advances have now made it possible for such systems to provide a broader range of services. Using mesh networks, Wi-Fi technology is already capable of providing area-wide coverage for broadband services; and Wi-Max technology, which functions over far greater ranges than Wi-Fi, can provide not only fixed broadband connections but mobile broadband services as well. Further technological progress in these areas seems highly likely.

Cognitive and software-defined radio technologies (sometimes called "agile" radios) allow transmitters to identify, in real time, unused portions of the electromagnetic spectrum and to target their transmissions to use only those unoccupied bands. Thus, for example, it is theoretically possible for cognitive radios to operate in the unused "white spaces" that exist either in the form of time (i.e., when a block of spectrum is used only intermittently) or geography (e.g., in the gaps between geographic areas that are used by—as opposed to allocated to—television broadcasters), without causing interference.

The theoretical promise of such applications has yet to be convincingly demonstrated in practice. Tests by the FCC of radios designed to utilize the so-called TV white spaces, for example, showed that the radios were not able to sense television transmissions with sufficient precision and certainty to avoid interference signals, even under "test-bed" conditions.[83] If such devices were deployed in "mass market" numbers, the problem becomes more complex, since their cumulative emissions might lead to interference, even if one or a few devices did not.[84] Moreover, there are some basic problems—such as when a "smart" radio is blocked by a building or other obstacle from sensing an interfering signal, and falsely concludes it is safe to transmit—which are not amenable to obvious solutions. Thus, it remains unclear when or whether such smart radios will become commercially practical, or for what applications.[85]

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83. *See* STEVEN K. JONES & THOMAS W. PHILLIPS, INITIAL EVALUATION OF THE PERFORMANCE OF PROTOTYPE TV-BAND WHITE SPACE DEVICES (FCC 2007).

84. *See* SPTF REPORT, *supra* note 39, at 26 ("Although the energy radiated by a single emitter might not be likely to cause harm, the cumulative emissions of secondary/unlicensed emitters and out-of-band emissions of primary licensed emitters and emitter types (radio telemetry, unlicensed devices, cell phones, etc.) could result in interference and, thus, must be considered. Technological changes in a communications system – for example, the type of waveform used to transmit a particular signal – also affect assessments of interference."). *See also* Steve Sharkey, Commercial Users, Address at Improving Spectrum Management through Economic or Other Incentives: A Workshop 172, 176 (Mar. 1, 2006), http://www.ntia.doc.gov/files/ntia/publications/spectrumworkshop_030106.pdf.

85. On September 23, 2010, the FCC issued further regulations for the use of "smart radios" in the TV white spaces. Unlicensed Operation in the TV Broadcast Bands*, Second Memorandum Opinion and Order*, 25 F.C.C.R. 18661 (2010). The FCC's *Order* included removing the requirement that white space devices contain interference-sensing technology,

The advent of spectrum sharing technologies has led to intense debate about how such technologies should be implemented. Advocates of market-oriented reform have argued that the property-rights approach they have advocated for many years can fully accommodate these new approaches, and indeed, will provide the proper incentives for their rapid introduction.[86] Others suggest that the property-rights model cannot accommodate spectrum sharing, and propose expanded use of spectrum "commons," in which spectrum is not licensed at all, and the use of "easements" (or "underlay rights") permitting use of such technologies even in blocks currently licensed for exclusive use.[87]

From the perspective of the spectrum reallocation debate, the facts above have two primary implications. First, technological progress has significantly improved spectrum efficiency, and likely will continue to do so. However, the rate of such progress is inherently difficult to predict. As noted above, some observers have gone so far as to predict "the end of scarcity." For example, an NTIA advisory panel opined in a May 2010 report:

> The communications industry is beginning the implementation of a new generation of cellular technology that incorporates smart antennas, Internet protocol, and other new techniques for content compression. Over the next 10 to 20 years, these new technologies will effectively multiply existing cellular-communications spectrum allocations by at least an additional 10 times. This is the equivalent of finding an additional 2500 MHz of spectrum for mobile wireless use.[88]

Conversely, many observers believe that, while there may be some additional efficiencies still to be captured by further implementation of technologies such as smart antennas, technology is approaching the theoretical physical limit of the amount of information capable of being carried over a wireless signal.[89]

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allowing them instead to rely on online databases.

86. *See, e.g.*, THOMAS M. LENARD ET AL., DIGITAL AGE COMMUNICATIONS ACT: REPORT FROM THE WORKING GROUP ON NEW SPECTRUM POLICY (The Progress & Freedom Foundation, Mar. 2006) [hereinafter DACA REPORT].

87. *See id.*

88. MICHAEL CALABRESE ET AL., REPORT FROM THE SPECTRUM INVENTORY WORKING GROUP OF THE COMMERCE SPECTRUM MANAGEMENT ADVISORY COMMITTEE 4 (2010) [hereinafter SIWG REPORT].

89. The theoretical limit is defined by Shannon's Law (sometimes called the Shannon-Hartley Theorem), which states that the maximum amount of information that a channel can carry depends upon its bandwidth and the strength of the desired signal relative to the strength of the noise in the channel. *See* MARK MACCARTHY, THE ASPEN INSTITUTE, RETHINKING SPECTRUM POLICY: A FIBER INTENSIVE WIRELESS ARCHITECTURE, 10 (2010) ("One participant observed that further improvements in spectral efficiency cannot be expected to continue indefinitely, noting that the efficiency of 4G service is approaching 75 percent of the Shannon's law limit. Other participants agreed, noting that some increases in

A second and related point is that technological change—in devices and services as well as in wireless technology itself—is driving changes in the marketplace which are also inherently unpredictable, and thus increase the importance of allowing spectrum to flow dynamically away from old uses into new uses.[90] In such an environment, it is common for services once regarded as promising (e.g., MSS) to fail in the marketplace (at least as originally envisioned), while demand suddenly emerges for new services (e.g., mobile TV) once regarded as unlikely to succeed.[91] The ability of spectrum to flow from market and technological "losers" to "winners" is essential, and—as the NBP seems to recognize—the only way for such transitions to occur in real time is through flexible licenses and effective secondary markets.

IV. THE CHOICES AHEAD

The NBP places heavy emphasis on the importance of spectrum policy, not just for communications but for the U.S. economy overall.[92] It advances an aggressive reform agenda, including proposals to create new tools for spectrum repurposing, facilitate the workings of secondary markets, develop new incentives for privatization of spectrum licensed or assigned to government, and increase reliance on unlicensed spectrum. Most famously, it calls for reallocating 500 MHz of spectrum to mobile broadband use within the next decade, at least in part through the use of voluntary incentive auctions.[93]

The extent to which the NBP's proposals ultimately comport with the spectrum policy consensus will depend on the outcomes of multiple rulemakings and, to some extent, on how Congress responds to the Plan's calls for statutory change.[94] A preliminary assessment gives cause for both

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efficiency were likely to continue, but that alone they would not enable channel capacity to increase enough to meet projected demand for wireless services."). *See also* Claude E. Shannon, *Communication in the Presence of Noise*, 37 PROC. OF THE IRE 10 (Jan. 1949), *reprinted in* 86 PROC. OF THE IEEE 447 (Feb. 1998), http://www.stanford.edu/class/ee104/shannonpaper.pdf.

90. *See, e.g.*, Everett M. Ehrlich et al., *The Impact of Regulation on Innovation and Choice in Wireless Communications*, 9 REV. OF NETWORK ECON. 1, 19–21 (2010); *see also* Robert Hahn & Hal J. Singer, *Why the iPhone Won't Last Forever and What the Government Should Do to Promote its Successor*, 8 J. ON TELECOMMS. AND HIGH TECH. L. 313 (2010) [hereinafter Ehrlich].

91. Lauren Goode & Amy Schatz, *Mobile TV Gets Closer as Backers Cut a Path,* WALL ST. J., Jan. 3, 2010, at B1.

92. NBP, *supra* note 1, at 75 ("Spectrum policy must be a key pillar of U.S. economic policy.").

93. *Id.* at xii.

94. Legislation to authorize the FCC's proposed "incentive auction" approach to reallocation has been introduced in the Senate by Sen. Rockefeller, S. 3756, 111th Cong.

hope and concern. On the one hand, the Plan emphasizes the importance of spectrum flexibility and secondary markets, calls for reliance on market incentives, and advances important principles for how to incentivize reallocation of both government and commercial spectrum.[95] On the other hand, the Plan also envisions an active government role in repurposing privately held spectrum,[96] and its proposals for freeing up additional government-encumbered spectrum may well (like past efforts) prove ineffectual. Moreover, the plan endorses several other policies, such as spectrum fees and build-out requirements that are at variance with the market-oriented consensus.

The discussion below begins with a detailed assessment of the NBP's proposal to reallocate 500 MHz of spectrum from alternative uses to mobile broadband, primarily through the use of incentive auctions and voluntary, market-oriented mechanisms. It next turns to the Plan's proposals for identifying and privatizing spectrum currently allocated to government use. The third section briefly addresses some of the Plan's other conclusions, such as its embrace of spectrum fees and build-out requirements, and places its recommendations in the context of other contemporaneous FCC actions (such as the *Skyterra Order*), which together seem to conflict with its overall market-oriented approach. The ultimate conclusion is that, while the NBP has the potential to accelerate the pace of market-oriented spectrum reform, it includes some proposals that could frustrate the achievement of that objective.

A. Repurposing Commercial Spectrum: Flexible Rights and Secondary Markets vs. Administrative Reallocation

The core of the modern spectrum reform consensus is that markets will do a better job of moving privately-held spectrum from lower- to higher-value uses than administrative processes.[97] As discussed above,

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(2010); and in the House by Rep. Boucher, H.R. 5947, 111th Cong. (2010).

95. NBP, *supra* note 1, at 73.

96. *Id.* at 81. As explained below, the NBP proposes that the FCC act as a "third party auctioneer" in its proposed incentive auction plan.

97. *See, e.g.*, Comments of 37 Concerned Economists, *supra* note 13; *see also* Robert Crandall et al., *Privatizing the Electromagnetic Spectrum*, FUTURE INSIGHT 3.1, Apr. 1996, at 1; *see also* Michael H. Rothkopf & Coleman Bazelon, *Interlicense Competition: Spectrum Deregulation Without Confiscation or Giveaways* 1–2 (New America Foundation, Spectrum Series Working Paper No. 8, 2003), http://web.si.umich.edu/tprc/papers/2003/182/Rothkopf_Bazelon.pdf. ("Economic efficiency suggests that existing license rights should be expanded to give users the flexibility to redeploy spectrum to its most valuable use and to trade licenses or unused capacity on secondary markets . . . . There is a general consensus at the FCC and among policy experts that the commercial use of spectrum should be largely deregulated, giving users far greater flexibility to determine the

there is widespread agreement that past efforts to repurpose spectrum through administrative processes have been inefficient, in part because the government is not well positioned to predict technological and market trends that affect spectrum demand, and in part because, even when such trends become self-evident, government is too slow in reacting to them. Hence, it is widely agreed that a market-oriented approach based on voluntary exchange would be superior.

There is widespread agreement that the task of actually creating workable spectrum markets is a difficult one. Ultimately, that task can be broken into two parts: (1) defining flexible rights; and (2) developing markets in which those rights can be traded. There is virtually universal agreement that the first task, defining property rights, falls clearly within the realm of government. In calling for more spectrum to be made available for broadband services, the NBP appropriately recommends that this new spectrum should be afforded greater flexibility in how it can be employed.[98] Although it also clearly states that licensees be allowed to freely trade their spectrum in the secondary market,[99] there is somewhat less agreement about the extent to which government should involve itself in the facilitation or creation of such secondary markets. Indeed, the NBP indicates a lack of confidence in the ability of secondary markets alone to repurpose spectrum currently subject to command-and-control regulation to new applications governed by flexible rights and market-oriented policies.

Thus, while the NBP adopts many of the concepts of the modern reform consensus, it also embraces (with qualifications) an outcomes-based approach premised on government's continued involvement in repurposing spectrum. In short, as explained below, the NBP neither clearly embraces nor clearly rejects the spectrum reform consensus. The proof, therefore, will come in decisions the FCC will make in the years ahead.

1. Costs and Delays of Administrative Reallocation

As noted above, one area where the NBP is in complete accord with the reform consensus is with respect to the long and costly lags associated with traditional, command and control repurposing. Spectrum reform advocates have long pointed to the lengthy delays associated with repurposing as a primary reason for moving to a market-oriented system of flexibility and secondary markets.[100] For example, FiberTower, a provider

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service provided on a band, or even to sell or sublease access to other firms through secondary market transactions.").

98. *See* NBP, *supra* note 1, at 78–79.

99. *Id.* at 83.

100. *See, e.g.*, DACA REPORT, *supra* note 86, at 1 ("The costs associated with

of wireless point-to-point backhaul services, filed a petition with the FCC in July 2004 to permit the use of smaller antennas in the 11 GHz band, which is also used for international satellite services.[101] The FCC finally approved the proposal more than three years later, in September 2007.[102]

In January 2005, Qualcomm petitioned the FCC for guidance on the interference rules that would apply to its intention to offer mobile video services in the 700 MHz band using its MediaFlo technology.[103] The FCC took more than twenty months to rule on the petition, finally issuing a Report and Order in October 2006.[104]

In 2006, the FCC auctioned off spectrum in the 1710–1755 MHz and 2110–2155 MHz bands for advanced wireless services ("AWS"), based on an agreement with federal agencies to vacate the spectrum.[105] Three years later, much of the spectrum had yet to be cleared[106] and the winning bidders in the AWS auction were not yet able to make full use of the spectrum.[107]

In March 2008, after many years of delay, the FCC auctioned spectrum in the 700 MHz block, which had previously been allocated to analog television.[108] While the FCC successfully auctioned over 1,000

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inefficient utilization of the spectrum under this 'command-and-control' system have become enormous . . . . Although it is difficult to quantify all of the costs associated with the current regime— especially the costs of innovations foregone or delayed—studies suggest that they could be in the tens of billions of dollars annually or even more.").

101. *See* Petition for Rulemaking, Amendment of Part 101 of the Comm'n's Rules to Increase Spectrum Use Through More Flexible Antenna Rules for the 10.7-11.7 GHz Band, FCC RM Docket No. 11043 (rel. May 26, 2004), *available at* http://fjallfoss.fcc.gov/ecfs/document/view?id=6516285211.

102. *See* Amendment of Part 101 of the Comm'n's Rules to Modify Antenna Requirements for the 10.7–11.7 GHz Band, *Report and Order*, 22 F.C.C.R. 17153 (2007) [hereinafter *Antenna Requirements Report and Order*].

103. *See* Petition for Declaratory Ruling, QUALCOMM Incorporated Petition for Declaratory Ruling that OET-69 is Acceptable to Demonstrate Compliance with Section 27.60, FCC WT Docket No. 05-7 (rel., Jan. 14, 2005), *available at* http://fjallfoss.fcc.gov/ecfs/document/view?id=6516890210.

104. Weiser & Hatfield, *supra* note 5, at 566.

105. *See* Fact Sheet, FCC, Auction 66: Advanced Wireless Service (AWS-1) (Apr. 27, 2009), http://wireless.fcc.gov/auctions/default.htm?job=auction_factsheet&id=66.

106. *But see* Applications of Cellco Partnerships, Verizon Wireless & Atlantis Holdings LLC, *Memorandum Opinion and Order and Declaratory Ruling*, 23 F.C.C.R. 17444, para. 66 (2008) [hereinafter Verizon-Alltel Order].

107. *See 1710–1755 MHz Introduction*, National Telecommunications and Information Administration (last visited Nov. 15, 2011), http://www.ntia.doc.gov/page/2011/1710-1755-mhz-introduction (providing links to information on the 1710–1755 MHz relocation); *see also* NTIA, DEP'T OF COMMERCE, RELOCATION OF FEDERAL RADIO SYSTEMS FROM THE 1710-1755 MHZ SPECTRUM BAND: SECOND ANNUAL PROGRESS REPORT (2009), http://www.ntia.doc.gov/files/ntia/publications/final2ndannualrelocationreport20090416. pdf.

108. *See* Fact Sheet, FCC, Auction 73: 700 MHz Band, (Feb. 10, 2009),

licenses, bids for the "D-Block" license, which was encumbered with public safety requirements, did not meet the reserve price.[109] Two months later, in May 2008, the FCC issued a Notice of Proposed Rulemaking proposing a new regime, but despite a commitment in the NBP that the FCC would issue new order in 2010, but action is still pending more than two years later.[110] In August 2010, Senator Rockefeller introduced legislation to reallocate the spectrum from commercial to public safety use and to use the proceeds from incentive auctions to provide funding to support an interoperable public safety network.[111]

Such delays directly harm consumers. For example, as a result of the delay in clearing the AWS spectrum, T-Mobile (which paid over $4 billion) was forced to delay plans to deploy mobile broadband services in competition with AT&T, Sprint, and Verizon.[112]

The NBP fully embraces these concerns, presenting a summary of recent spectrum repurposing proceedings in Figure 6, which demonstrate the long delays associated with administrative reallocation. As the FCC notes, "[t]he process of revisiting or revising spectrum allocations has historically taken 6-13 years . . . ."[113]

FIGURE 6:
TIME REQUIRED TO REALLOCATE SPECTRUM THROUGH ADMINISTRATIVE PROCESS[114]

Band	First Step	Available for Use	Approximate Time Lag
Cellular (Advanced Mobile Phone System)	1970	1981	11 years
PCS	1989	1995	6 years
Educational Broadband Service (EBS)/Broadband Radio Service (BRS)	1996	2006	10 years
700 MHz	1996	2009	13 years
AWS-1	2000	2006	6 years

Thus, the NBP seems to be fully in accord with the modern consensus that administrative reallocation is a long and cumbersome process.

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http://wireless.fcc.gov/auctions/default.htm?job=auction_factsheet&id=66.

109. *See* Implementation of Section 6002(b) of the Omnibus Budget Reconciliation Act of 1993, Annual Report and Analysis of Competitive Market Conditions with Respect to Commercial Mobile Services, *Thirteenth Report*, 24 F.C.C.R. 6185 (2009).

110. *See* NBP, *supra* note 1, at 84 (providing that the FCC confirmed its intention to issue a new D-Block Order in 2010).

111. S. 3756, 111th Cong. (2010).

112. Comments of T-Mobile USA, Inc., Relocation of Federal Systems in the 1710-1755 MHz Frequency Band: Review of the Initial Implementation of the Commercial Spectrum Enhancement Act, FCC Docket No. 0906231085-91085-01 (rel. Aug. 21, 2009) [hereinafter T-Mobile Aug. 2009 Comments].

113. NBP, *supra* note 1, at 79.

114. *Id.*

2. Creating Incentives for Incumbent Licensees to Vacate Underutilized Spectrum

A second area where the NBP and the modern consensus are in at least partial accord is with respect to the benefits of providing incentives for incumbents to reallocate their spectrum. From the perspective of the modern consensus, allowing license holders to share in the value creation associated with spectrum reallocation goes hand in hand with the concept of spectrum flexibility and tradable rights, the very purpose of which is to provide incentives for licensees to increase the value associated with their spectrum, or to lease or sell it to someone who can.[115] The political perception, however, has been that such gains constitute inequitable windfalls, which should be taxed away, or not permitted at all.[116]

Spectrum reform proponents have responded to the "windfall" argument in a variety of ways, including noting that virtually all current spectrum licensees paid for their spectrum,[117] that increases in the value of the spectrum resulting from private investment properly belong to those making the investments,[118] that windfalls are inherent in many beneficial government activities (e.g., building interstate highways benefits those who own land nearby), and that, in any case, the broad-based application of spectrum flexibility would dramatically increase the supply of spectrum in the market, and thus limit or even potentially eliminate any windfalls.[119]

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115. *See* Comments of 37 Concerned Economists, *supra* note 13, at 6 n.5 ("The license flexibility advocated throughout this filing may appear to be a 'windfall' for incumbents, as operators are permitted to use spectrum more productively. However, a general FCC policy permitting greater flexibility will simultaneously reduce license values by introducing increased competitiveness. Net 'windfalls' may be positive or negative, and will vary case by case. What is clear, however, is that more efficient use of spectrum will benefit consumers. Efforts to extract gains from licensees (or compensate for losses) should not be permitted unduly to hinder or delay realization of the public benefits from promoting greater competitiveness through spectrum liberalization.").

116. *See, e.g.*, DACA REPORT, *supra* note 86, at 19 ("[Granting flexibility to incumbents] entails the perception of large giveaways that are likely to be unacceptable to many people. Giving the current incumbents increased flexibility would increase efficiency, but the reality is that there would be winners and losers, which would also be perceived as unfair and would likely lead to substantial litigation, delaying the transition to a market-driven regime."). *See also* J.H. Snider, *The Art of Spectrum Lobbying: America's $480 Billion Spectrum Giveaway, How it Happened, and How to Prevent it from Recurring*, (New America Foundation, Working Paper No. 19, 2007).

117. For example, virtually all broadcast stations have changed hands at least once since originally receiving their broadcast licenses, and the implicit value of the spectrum was incorporated in the sale price of the station at the time of sale.

118. *See* AYN RAND, THE PROPERTY STATUS OF AIRWAVES (1996), *reprinted from* AYN RAND, CAPITALISM: THE UNKNOWN IDEAL (New American Library ed., 1964).

119. *See Property Rights*, *supra* note 43, at 565 ("[L]icenses issued by countries awarding substantially more extensive property rights are less valuable than other licenses.

Most importantly, it is noted, letting incumbents profit from reallocation is what makes flexibility work: it creates the incentive for change, which is the whole idea.

As discussed further below, the question of how gains from flexibility can be shared between the incumbent and the government is closely related to the precise nature of the flexibility granted and the mechanism by which reallocation is proposed to occur. The simplest option is to grant licensees flexibility and, if government feels the need to expropriate some of the resulting gains, to impose a tax or fee. Indeed, as noted above, this is what Congress did in amending Section 336 of the Communications Act (permitting partial flexibility for the ATV spectrum but requiring the FCC to establish a fee on ancillary or supplementary services).[120] Another option involves auctioning "overlay" rights, which give entrants exclusive rights to negotiate with incumbents, who continue to have at least some rights to demand compensation as a condition of vacating their spectrum.

Yet another approach to incentivizing reallocation is to offer incumbents some combination of carrots and sticks designed to encourage them to agree "voluntarily" to put their spectrum up for sale in a government-run auction. The proposed carrots typically include some share of the auction proceeds, while the sticks may include the offering (or withholding) of a variety of regulatory benefits such as, in the case of broadcasters, continued must-carry rights.[121] The NBP adopts this carrot and stick approach in the form of "incentive auctions":

> Given the practical challenges of reallocation, the FCC needs to create new incentives for incumbent licensees to yield to next-generation users . . . . Contentious spectrum proceedings can be time-consuming, sometimes taking many years to resolve, and incurring significant opportunity costs. One way to address this challenge is by motivating

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The difference is large—about 61 percent. These findings offer important evidence as to the direction of windfalls associated with far-reaching liberalization of radio spectrum rights.").

120. 47 U.S.C. § 336 (2006); *see also* discussion *infra* Part II.A.

121. *See* Weiser, *supra* note 48, at 20 ("To facilitate win-win trades between UHF TV broadcasters and other higher-value uses of spectrum (such as wireless broadband providers), I recommend a two-part program. First, such trades should be facilitated through a government-managed auction process, and subject to some form of a windfall tax. From a policy perspective, the most critical aspect of this tax is that it should be high enough to address the concern of unfair windfalls, but not too high such that it renders unprofitable or undesirable sales of UHF TV spectrum licenses. Second, as an incentive to make such trades, the UHF broadcaster should also be afforded the opportunity to exercise its must-carry right for some continuing period after it sold its right to use the radio spectrum (and thus be able to demonstrate the value of its content for purposes of a commercial carriage agreement with the relevant cable and satellite providers). This transitional right to have programs carried on cable and satellite platforms would create a powerful incentive for stations with limited over-the-air viewership to consider selling their underlying transmission rights."). *See also* Kwerel & Williams, *supra* note 46, at iv.

> existing licensees to voluntarily clear spectrum through incentive auctions.[122]

As discussed further below, such auctions are proposed as a mechanism for reallocating both ATV and MSS spectrum.[123] On July 15, 2010, the FCC adopted a notice of proposed rulemaking and notice of inquiry to remove regulatory barriers to terrestrial use of MSS spectrum in the 2 GHz, Big LEO, and L-band frequencies.[124] The notice of inquiry seeks comment on whether "voluntary incentive auctions" would be "an appropriate mechanism for providing an option for incumbent 2 GHz MSS licensees to vacate the band in favor of mobile broadband providers operating on new licenses[.]"[125]

As the NBP notes, the FCC's ability to share the proceeds of auctions with current licensees would require Congressional approval—a fact which perhaps explains, at least in part, why the NBP emphasizes that:

> [a]lthough sharing auction proceeds through incentive auctions means that some funds paid for spectrum will not go to the U.S. Treasury, incentive auctions should have a net-positive revenue impact for a variety of reasons: accelerated clearing, more certainty about costs, and the ability to auction adjacent spectrum that, due to technical rules, is not currently licensed."[126]

3. Facilitating (or Operating) Secondary Markets

The question of how much government can or should do to facilitate the development of secondary markets is a subject of continuing debate among economists and policymakers. Some economists argue that secondary markets can function effectively with a minimum of government involvement or, indeed, that they already are.[127] Others take the view that

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122. NBP, *supra* note 1, at 81. *See also* Genachowski, *supra* note 41, at 5 ("[The NBP] proposes voluntary incentive auctions—a process for *sharing with broadcasters a meaningful part of the billions of dollars of value* that would be unlocked if some broadcast spectrum was converted to mobile broadband.") (emphasis added).

123. *See* NBP, *supra* note 1, at 88 ("Exercise of this option [granting terrestrial rights to MSS licensees] should be conditioned on construction benchmarks, *participation in an incentive auction*, or other conditions designed to ensure timely utilization of the spectrum for broadband and appropriate consideration for the step-up in the value of the affected spectrum.") (emphasis added).

124. *See* Fixed and Mobile Servs. in the Mobile Satellite Serv. Bands at 1525–1559 MHz and 1626.5–1660.5 MHz, 1610–1626.5–2483.5–2500 MHz and 2000–2020 MHz and 2180-2200 MHz, *Notice of Proposed Rulemaking and Notice of Inquiry*, 25 F.C.C.R 9461 (2010) [hereinafter Fixed and Mobile Servs.].

125. *Id.* at para. 28.

126. NBP, *supra* note 1, at 82 (citation omitted).

127. John W. Mayo & Scott Wallsten, *Enabling Efficient Wireless Communications: The Role of Secondary Spectrum Markets*, 22 INFO ECON. & POLICY 61, 62 (2010).

various market imperfections require more active government participation.[128] The NBP comes down firmly in favor of the latter view.[129]

As a preliminary matter, there *is* a broad-based consensus on at least a de minimis government role as a provider of accurate information about spectrum licenses.[130] As noted above, this consensus led, in the late 1990s, to the development of the Universal Licensing System, which makes available information about the identity of spectrum licensees as well as rudimentary information about the characteristics of the licenses themselves (e.g., market areas, permitted services). Simultaneous with the release of the National Broadband Plan, on March 17, 2010, the FCC announced the launch of a new "Spectrum Dashboard," which provides enhanced search and mapping capabilities and an improved user interface.[131] Further, Congress is considering legislation (S.649, introduced March 19, 2009 and H.R. 3125, introduced on July 8, 2009, and passed by the House on April 13, 2010)[132] which would mandate a jointly managed FCC-NTIA "spectrum inventory" of both commercial and government spectrum. The NBP endorses continuing efforts to improve the availability of information about spectrum licenses in order to promote the functioning of secondary markets.[133]

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128. *See, e.g.*, Kwerel & Williams, *supra* note 46.

129. NBP, *supra* note 1, at 81–82.

130. *See, e.g.*, DACA REPORT, *supra* note 86, at 11–12.

131. Press Release, FCC, Commission Announces "Beta" Launch of Spectrum Dashboard (Mar. 17, 2010), http://hraunfoss.fcc.gov/edocs_public/attachmatch /DOC-296942A1.pdf. *See also Spectrum Dashboard*, FCC, http://reboot.fcc.gov/reform/systems/spectrum-dashboard (last visited Nov. 15, 2011).

132. *See generally* H.R. REP. NO. 111-462 (2010), http://frwebgate.access. gpo.gov/cgi-bin/getdoc.cgi?dbname=111_cong_reports&docid=f:hr 462.111.pdf.

133. *See* NBP, *supra* note 1, at 80–81. The NBP also endorses additional efforts to measure spectrum use (i.e., the extent to which spectrum license holders are actually using the spectrum rights they currently hold). *Id.* at 80 (acknowledging the need to "understand[] how, where and when spectrum resources are being used," and recommending that "the FCC and NTIA . . . develop scientific, statistically valid methods to measure and report the utilization of spectrum bands between 225 MHz and 3.7 GHz." (citations omitted)). At the present time, there is little agreement about how to measure "efficient" spectrum use. *See generally*, COMMERCE SPECTRUM MGM'T ADVISORY COMM., DEFINITIONS OF EFFICIENCY IN SPECTRUM USE, (2008), http://www.ntia.doc.gov/files/ntia/publications /spectral_efficiency_final.pdf. *See also* SPTF REPORT, *supra* note 39, at 21 ("The Task Force also attempted to develop a methodology for measuring spectrum efficiency. It concluded that while it is generally easiest to assess technical efficiency on a per-device basis in terms of bits/seconds/hertz, after reviewing the comments and the record, it was neither possible nor appropriate to select a single, objective metric for comparing spectrum efficiency across different radio services. Any metric would, inherent in its assumptions, provide advantages to one service or another. In addition, measuring technical efficiency does not provide any information with respect to economic efficiency.").

Beyond the need for greater visibility into spectrum licensing and usage, there is relatively little agreement about the role government should play in facilitating secondary market transactions. Some economists argue that secondary markets are already operating relatively efficiently, that they will continue to do so if the FCC were simply to grant increased flexibility to existing licensees, and that extensive government intervention is therefore not required.[134] For example, a recent study by John Mayo and Scott Wallsten concludes:

> [T]he FCC has radically reduced the time it takes to approve trades, making the system more akin to notification than to approval. We also find that a large amount of spectrum changes hands each year. For example, the average amount of PCS spectrum in terms of MHz-Pops that changed hands each year between 2004 and 2008, not including leases, was approximately equal to the amount of spectrum auctioned by the FCC in the 2006 AWS auction.[135]

Other economists have argued that various market failures, including transaction costs, fractured or ambiguous property rights, and "hold-out" problems, are likely to prevent spectrum markets from operating efficiently in many cases, and that government therefore needs to take a more active role.[136] Proposals to address such problems include more clearly defining and clarifying the package of rights associated with spectrum licenses (including specifically defining interference limits),[137] auctioning off "overlay" rights giving winners exclusive rights to negotiate with incumbents,[138] or orchestrating auctions in which incumbent spectrum

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134. *See, e.g.*, Comments of 37 Concerned Economists*, supra* note 13, at 5 ("In promoting secondary markets, the Commission should generally remove restrictions and not mandate the terms upon which spectrum markets emerge . . . . Instead of either preventing or requiring a secondary market, the Commission should quickly restructure its rules to *allow* a secondary market.").

135. *See* Mayo & Wallsten, *supra* note 127. *See also* Crocioni, *supra* note 44, at 460 (concluding that "[t]here appear to be no strong reason to conclude that [hoarding and concentration] may be larger [risks] than in any other sector of the economy.").

136. *See, e.g.*, *Efficiency of FCC Spectrum Auctions*, *supra* note 17, at 728 ("Postauction transactions are often made difficult by strategic behavior between parties with private information and market power. The experience with the cellular lotteries is a case in point. It took a decade of negotiations and private auctions for the eventual service providers to acquire desirable packages of licenses from the lottery winners. Efficient auctions are possible before assignments are made but may become impossible after an initial assignment. The problem is that the license holder exercises its substantial market power in the resale of the license. For this reason, it is important to get the assignment right the first time." (citation omitted)).

137. *See* Weiser & Hatfield, *supra* note 5.

138. *See* Comment Submitted by Thomas W. Hazlett, International Comparison and Consumer survey Requirements in the Broadband Data Improvement Act, FCC GN Docket No. 09-47 (rel. Dec. 18, 2009), *available at* http://fjallfoss.fcc.gov/ecfs/document /view?id=7020353683.

holders can voluntarily put their spectrum on the market in return for a portion of the proceeds.[139]

The NBP acknowledges there is at least "some evidence" secondary markets have been effective in transferring spectrum among current holders:

> [T]here have been thousands of secondary-market transactions involving mobile broadband licenses over the last several years. These have included license transfers, including partitioning and disaggregation, and spectrum leases, thus providing some evidence that the FCC's policies have enabled 'spectrum to flow more freely among users and uses,' as envisioned in the Commission's Secondary Markets Policy Statement.[140]

Despite this assessment, the NBP indicates there may be occasions when the government should play the role of "third-party auctioneer," and specifically proposes the use of "incentive auctions."[141] As described in the Plan:

> [T]he FCC could act as a third-party auctioneer for the private exchange of spectrum between willing sellers and buyers, similar to a fine art auction. Alternatively, the FCC could offer a revenue-sharing enhancement to the existing spectrum auction system, in which some portion of revenues generated by an auction are shared between the U.S. Treasury and incumbent licensees who agree to relinquish their licenses.[142]

The incentive auction proposal represents an innovative effort to combine the advantages of secondary markets (which give incumbents incentives to relocate) with the putative advantages of government auctions (which allow government to restructure and "repack" license rights in order, at least in theory, to increase their value to the ultimate users).[143] The Plan explains its choice of incentive auctions over the auctioning of overlay rights on the

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139. *See* DACA REPORT, *supra* note 86, at 13–20.

140. NBP, *supra* note 1, at 83 (citations omitted). The Plan also calls for examining some technical changes in the FCC's secondary market rules. ("In particular, the FCC should examine additional positive incentives that may assist in the development of secondary markets, such as reducing secondary market transaction costs like lease filing costs, and encouraging and facilitating the use of dynamic spectrum leasing arrangements that harness emerging technologies.").

141. *Id.* at 81. The NBP proposes to apply incentive auctions to both MSS and ATV spectrum. With respect to the latter, it proposes to (a) revise broadcast spectrum licenses so as to "repack" stations, (b) permit stations to share spectrum, so that two (or conceivably more) stations could broadcast from the same facilities, using the same 6 MHz blocks of spectrum, and (c) conduct an auction of spectrum which broadcasters decided to put up for sale. *See generally id.* at 88–92.

142. *Id.* at 81–82 (citation omitted).

143. *See, e.g.*, Kwerel & Williams, *supra* note 46, at i ("By ensuring that most interdependent spectrum is up for sale at the same time, this proposal would facilitate a rapid and efficient restructuring of spectrum rights and use.").

grounds that "these piecemeal voluntary negotiations [subsequent to an overlay auction] between new licensees and incumbents introduce delays as well as high transaction costs as new licensees contend with holdouts and other bargaining problems."[144]

The NBP's proposal for incentive auctions thus embraces the need for government to step in to address market failures in secondary spectrum markets by actively engaging in market design and acting as a third-party auctioneer. What remains unclear is whether the benefits of such an approach would exceed the costs. On one hand, a purely market-oriented approach would undeniably face the high transaction costs and other barriers to which the NBP points. On the other, the incentive auction approach also has potential for costs and delays—beginning with the need for Congressional approval.[145]

As noted above, there is no apparent consensus on the ideal role for government in establishing and facilitating secondary markets. What can be said is that the costs of error—in either direction—could be extremely high, holding the potential to delay by many years the redeployment of a very valuable economic resource in a crucial sector of the economy.[146] Thus, there is a clear need for additional research into the comparative advantages and disadvantages of different approaches.[147]

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144. NBP, *supra* note 1, at 82. This conclusion is echoed in the technical paper released subsequently. *See OBI Technical Paper, supra* note 3, at 25 ("The downside of [an overlay] auction is that incumbents may choose never to clear the band or may take a very long time to negotiate a clearing.").

145. Perhaps surprisingly, the legislation, introduced by Senator Rockefeller and Representative Boucher, won the support of the National Association of Broadcasters, which stated that it has "no quarrel with incentive auctions that are truly voluntary . . . ." *Rockefeller Spectrum Bill Endorses Voluntary Spectrum Return Concept*, RBR.COM (Aug. 6, 2010, 1:52 AM), http://www.rbr.com/tv-cable/26529.html.

146. The question of what role the FCC should play in reallocating spectrum was carefully considered by an FCC working group in 2002. The working group developed seven criteria that the Commission could use to determine what type of mechanism to choose. *See* SPTF REPORT, *supra* note 39, at 51. One of the options listed by the report was "expanded rights," which it described as follows: "Under [expanded rights] option, the Commission grants expanded flexible rights directly to incumbents through modification of their existing licenses. Potential new entrants are not able to bid for or otherwise obtain these expanded rights, except by acquiring the licenses from incumbents through the secondary market. This option has been used by the Commission in several bands. For example, in the CMRS Flexibility proceeding, the Commission granted CMRS providers the right to provide fixed in addition to mobile services under their existing licenses." See DACA REPORT, *supra* note 86, at 19–20 for a similar discussion.

147. The *OBI Technical Paper* details the FCC's efforts to develop an empirical model capable of predicting the potential benefits of various approaches to reallocating ATV spectrum, including channel sharing and the repacking of channels. Unfortunately, the model is at an early stage of development and not yet capable of predicting the effects of incentive auctions. *OBI Technical Paper, supra* note 3, at 5 ("For example, once

4. Defining Interference Standards

Spectrum reform advocates assert that the imposition by the FCC of technological standards designed to prevent "harmful interference" is economically inefficient and has slowed innovation. At the same time, they recognize that government has a role to play, at least initially, in defining interference standards—that is, in defining the levels at which spectrum licensees need not suffer interference as well as the responsibility not to cause interference for other licensees. Indeed, interference protection rights are a key element of the package of rights parties acquire when they obtain spectrum licenses. Past government spectrum reform efforts have attempted to grapple with the definition of interference rights. The NBP, interestingly, is essentially silent on the topic.

Preventing "harmful interference"[148] is seen by some as the central objective of spectrum policy.[149] Obviously, however, the objective cannot be to prevent *all* interference—as doing so would require vastly reducing the use of spectrum, to say nothing of doing away with electric drills and blenders. Rather, the objective is to manage interference so as to balance the costs of reducing interference with the benefits of doing so.[150]

The task of determining and enforcing the efficiency-maximizing level of interference is technically complex. Interference can occur as a result of competing transmissions occurring within the same band, but also takes the form of "out-of-band" interference in neighboring bands. Different types of services and technologies vary in their sensitivity to interference; and, different types of transmissions, even taking place in the

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development of this model is complete, the FCC will be able to determine how many stations in which markets could participate voluntarily in an incentive auction in order to make progress towards freeing 120 megahertz with the minimal possible impact on service areas and consumers, or potentially develop alternative scenarios to meet the spectrum objective. The alpha version of this tool, though it cannot yet provide that degree of insight, has already assisted in informing recommendations in the Plan and, with other FCC analytical tools, assessing the potential impact on consumers and broadcasters from various scenarios. The model is a work in progress . . . .").

148. Section 303(f) of the Communications Act of 1934, as amended, directs the FCC to make regulations "it may deem necessary to prevent interference between stations" as the public interest requires. Communications Act of 1934, ch. 652, 48 Stat. 1064 (codified at 47 U.S.C. § 303(f)).

149. *See, e.g.*, DACA REPORT, *supra* note 86, at 1 ("The central problem in the use of the electromagnetic spectrum is 'interference': one party's transmissions interfering with those of another party in the same (or a neighboring) geographic area and/or spectrum band.").

150. *Id.* at 8 ("The appropriate social goal (with respect to interference) should be to minimize the sum of all relevant costs (including opportunity costs): the costs of interference, interference abatement, and interference coordination/enforcement.") (citation omitted).

same geographic area at the same level of power, may result in different levels of (or types of) interference (e.g., the very short "burst" transmissions associated with spread spectrum technology may be too brief to cause noticeable interference with some services operating in the same bands). Moreover, identifying the cause of interference can be very difficult for a number of reasons; including the fact that interference is a function of weather and other environmental factors which are constantly changing.[151]

The economic challenge is made still harder by the fact that there are generally two solutions to interference: to modify the characteristics of the interfering transmission (e.g., by reducing its power), or to modify the characteristics of the receiver that is affected (e.g., by installing better filtering technology). In cases where the party whose transmissions cause interference and the party whose services are harmed by interference are one and the same—i.e., so long as the costs of interference are internalized—that party will have the appropriate incentives to achieve the efficient level. But in cases where the interfering and interfered with parties are different, interference constitutes an externality.

The question facing policymakers is whether administrative procedures and regulations can do a better job than markets and property rights in achieving the efficient level of interference. Traditionally, interference management has taken the form of ex ante regulation by the FCC, which has set geographic boundaries, prescribed transmission technologies, limited the output of transmitters, and imposed other conditions on both licensees and devices designed to prevent "harmful interference."[152] Such a policy conflicts directly with the goal of increasing flexibility and allowing spectrum to flow to higher-value uses. Moreover, there is general agreement that it has resulted in a variety of distortions and uneconomic outcomes. For example, the FCC has typically focused on policing interfering transmitters, while paying little or no attention to the (sometimes more efficient) approach of reducing the consequences of interference by improving receivers.[153]

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151. See Weiser & Hatfield, *supra* note 5, at 575–83, for an excellent discussion on some of these complexities.

152. An exception is the PCS band, where interference limits consist simply of geographic and frequency-based limits on in- and out-of-band emissions. Kwerel & Williams, *supra* note 46, at 45.

153. SPTF REPORT , *supra* note 39, at 31 ("As noted earlier, Commission regulations for controlling interference set forth permissible technical operational parameters for transmitters. Receiver robustness generally has not been taken into account in Commission regulations . . . . This transmitter-centric policy is not necessarily efficient in today's spectrum environment."). The Task Force proposed that the FCC take a more balanced—if hardly market-oriented—approach going forward by imposing performance standards on

The administrative approach has also resulted in costly miscalculations. For example, the FCC approved Nextel's use of the 800 MHz band in the belief that Nextel's services would not interfere with the transmissions of public safety agencies in neighboring bands.[154] As a result, both Nextel and public safety invested substantial sums in equipment and infrastructure, only to see those investments degraded by unanticipated interference. Ultimately, the FCC was forced to engage in a lengthy and costly exercise in "spectrum swapping," which is still in process.[155] Similarly, as noted above, the FCC's technical rules for WCS/SDARS spectrum have effectively prevented the efficient use of WCS for mobile use for more than a decade, since the spectrum was auctioned in 1997.[156]

Spectrum reform proponents favor an alternative approach: to define clearly the rights of spectrum holders to be protected from interference, and their obligations not to interfere with others, and then allow disputes to be settled through negotiation and/or case-by-case adjudication. There is general agreement that government should take the lead, at least initially, in defining interference standards,[157] but there is also agreement that defining these rights and responsibilities is a difficult task.[158]

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receivers. *Id.* at 21 ("The Task Force recommends that the Commission consider applying receiver performance requirements, either through incentives, regulatory mandates, or some combination of incentives and mandates.").

154. *See, e.g.*, LINDA K. MOORE, SPECTRUM POLICY: PUBLIC SAFETY AND WIRELESS COMMUNICATIONS INTERFERENCE,1 (2010), http://www.fas.org/sgp/crs/misc/RL32408.pdf ("When the frequencies in the 800 MHz band were first assigned, the FCC did not anticipate that channels in that band intended for short messages over commercial mobile radio (used by taxi dispatchers, for example) would—with time, technology, and soaring consumer demand for wireless service—be converted to a heavily-trafficked national cell phone network. The commercial allocations at 800 MHz were closely interleaved with public safety allocations, with the expectation that the (presumably) low-usage commercial assignments would act as buffers to prevent interference with public safety channels.").

155. *See id*. *See also* Letter from Sprint Nextel at 1, Sprint Nextel's Status Report on 800 MHz Band Reconfiguration, WT Docket No. 02-55 (rel. Oct. 3, 2011), *available at* http://fjallfoss.fcc.gov/ecfs/document/view?id=7021712460.

156. See generally *WCS/SDARS Order*, *supra* note 27, at paras. 5–27 for a summary of the issues and a procedural history of the Commission's long and heretofore unsuccessful efforts to resolve them.

157. *See* Comments of 37 Concerned Economists, *supra* note 13, at 5 ("To facilitate this transition to market allocation, the Commission should focus on improving the definition of interference for existing licensees . . . .").

158. In 2002, the SPTF proposed a new approach to interference management, which would create a quantitative "interference temperature" benchmark for each band. Transmissions rising above the interference benchmark would be prima facie considered to be causing "harmful interference," while those remaining below it would be prima facie permitted. SPTF REPORT, *supra* note 39, at 27–30. In 2007, based on a large body of technical evidence, the FCC dropped the idea in a two-page order, concluding it was "not a

Some suggest that a relatively simple set of "best guess" standards, modified over time by negotiation among spectrum rights holders (and, where necessary, adjudication), would be both more efficient and more easily administered than the command and control approach used in the past,[159] while others argue that simply allowing negotiations between market participants would be adequate.[160] Still others have argued for the use of "predictive models" to establish interference boundaries.[161] Kwerel and Williams have suggested that the FCC establish de minimis performance standards for transmitter emissions, which could be altered going forward through negotiations between licensees.[162] The current limits on transmissions by PCS licensees have been suggested as a reasonable first approximation of where these limits (for out-of-band transmissions) would be set.[163] The advantage of this approach is that it permits licensees to negotiate among themselves to identify the most efficient level of interference. The problem, of course, is that it still requires the FCC to set the initial limits. To set such limits, however, would require the FCC to define the "harmful interference" more precisely than it has been willing to do in the past.[164]

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workable concept." Establishment of an Interference Temperature Metric to Quantify and Manage Interference and to Expand Available Unlicensed Operation in Certain Fixed, Mobile and Satellite Frequency Bands, *Order*, 22 F.C.C.R 8938, para. 2 (2007).

159. DACA REPORT, *supra* note 86, at 7–10. As noted above, advocates of the "commons" approach take a different tack, suggesting that exclusive spectrum rights (and hence protection from interference) are unnecessary altogether—at least for many uses—because new technologies have obviated the interference problem altogether.

160. *See, e.g.*, Comments of Thomas Hazlett & Matthew Spitzer at 5, Establishment of an Interference Temperature Metric to Quantify and Manage Interference and to Expand Available Unlicensed Operation in Certain Fixed, Mobile and Satellite Frequency Bands, ET Docket 03-237 (rel. April 5, 2004).

161. *See, e.g.*, Weiser & Hatfield, *supra* note 5, at 608.

162. *See* Kwerel & Williams, *supra* note 46, at 46–47 ("The initial limit set by regulation should rule out extreme power levels that have little practical benefit but which, if left unchecked, could lead to excessive interference risk or harmful strategic behavior. A reasonable power limit is one that is high enough to accommodate most anticipated transmitter systems while helping to constrain 'worse case' interference assumptions on the receiving side. A high degree of precision in setting the limit is not necessary since licensees will have the ability to reset it more optimally through negotiation, albeit also at some cost."); *see also* DACA REPORT, *supra* note 86, at 7–9 (endorsing the same approach); Evan Kwerel & John Williams, Defining Spectrum Rights, NTIA Workshop on Improving Spectrum Management (Feb. 28 – March 1, 2006), http://www.ntia.doc.gov/forums/2006/specman/ntia_kwerel.pdf.

163. Kwerel & Williams, *supra* note 46, at 45.

164. *See* R. Paul Margie, *Can You Hear Me Now? Getting Better Reception from the FCC's Spectrum Policy*, 2003 STAN. TECH. L. REV. 5, para. 6, *available at* http://intel.si.umich.edu/tprc/archive-search-abstract.cfm?PaperID=214. Yet another variant would be to grandfather the existing level of interference protection for each licensee and allow licensees to negotiate modifications to those parameters. The advantage of this

The NBP does not directly address the question of establishing interference standards, at least not in a generic or comprehensive way, but instead proposes new technical standards for particular bands (e.g., laying out several potential changes to the technical architecture of the ATV spectrum, including moving towards a low-power, "cellular" architecture).[165] Thus, it appears that the Plan envisions that for some bands the FCC will continue to police interference through the administrative application of government-designed technological standards.

5. Defining Success in Spectrum Reallocation: Market Outcomes vs. Administrative Goals

The central tenet of the reform consensus is that ultimately markets rather than regulators should decide how spectrum is allocated. This tenet rests, in part, on the thesis that regulators are not able to predict accurately changing demands for spectrum for various uses.[166] The NBP is somewhat ambiguous on both of these issues, but appears in the end to see market mechanisms as tools for achieving administratively-determined spectrum allocation objectives.

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approach is that it is consistent with the existing allocation of resources: licensees have invested in infrastructures and deployed services consistent with current levels of interference. Since renegotiations between licensees will determine (and adjust) interference parameters over time (as Kwerel and Williams point out), there is no apparent reason to set the default parameters at any level different from the status quo. Another advantage of this approach is that it is likely to minimize (and facilitate resolution of) future disputes, since the current level of interference is a knowable quantity. Thus, as licensees introduce new technologies and spectrum uses, they will be able to know in advance that the current level is the level of interference they may cause interference to their neighbors without having to enter into negotiations or risk sanctions. *See, e.g.*, Cave, *supra* note 43 ("Trading should be introduced in a way which minimises transactions costs, consistent with maintaining the integrity of the spectrum management regime. This will entail giving licensees the freedom to divide and partition their licences by frequency and geography for subsequent sale. In these cases, rights and regulatory responsibilities for interference management would be sold together. Spectrum users should also be able to lease access to frequencies to others. In these cases, the original licensee would share access to frequencies while retaining responsibility to the regulator for the conduct of the licence.").

165. NBP, *supra* note 1, at 90. Similarly, the FCC's approach in the *WCS/SDARS Order* was to prescribe revised technical standards, rather than moving towards an interference standard approach. *See WCS/SDARS Order*, *supra* note 27, at paras. 28–301 (prescribing service rules for WCS and SDARS services).

166. *See, e.g.*, Comments of 37 Concerned Economists, *supra* note 13, at 3 ("Moreover, in a dynamic world many things change, including the state of technology, the development of wireline networks, and the imagination of entrepreneurs to invent new applications for radio devices. The Commission has recognized that regulators have limited ability to plan markets . . . . But auctions for licenses have not changed the underlying system of spectrum allocation . . . . With few exceptions, spectrum continues to be offered to the market only as allocated and no price can be offered to reallocate it from the officially designated use.").

With respect to government's ability to predict the demand for spectrum and thus make economically sound decisions about the ultimate allocation of spectrum to various uses, the NBP acknowledges the reform consensus view that the supply and demand for spectrum are volatile and difficult to predict:

> Spectrum forecasts all incorporate a range of assumptions about future network capacity. Demand is difficult to predict due to uncertainties about future devices and user behavior. Supply is also difficult to predict since new technologies can change underlying operating costs, and access to key inputs like backhaul and tower sites can be limited by regulatory and other barriers.[167]

Nevertheless, despite acknowledging these difficulties, the Plan embraces specific forecasts of future market conditions and translates these forecasts directly into predictions of the amount of additional spectrum that will be required for specific uses (e.g., mobile broadband) over specific time periods.[168] These predictions, in turn, form the basis for specific quantified goals and objectives (e.g., reallocating 300 MHz to mobile broadband in the next five years and 500 MHz in the next ten years).[169] From the perspective of the reform consensus, the relevant question is whether these goals represent notional targets that form the basis for development of market-oriented policies or, alternatively, represent firm objectives to be achieved one way or another.

The NBP does not provide a clear answer. On one hand, it indicates a preference for voluntary exchanges conducted through secondary markets[170] and even suggests the amount of spectrum that ultimately is reallocated will not be determined by the FCC but instead by "self-correcting market forces,

> [T]he use of flexible mechanisms such as incentive auctions to meet the need for more spectrum ensures that *the market will self-correct if the forecast proves to be inaccurate*. If the U.S. needs more than 300 additional megahertz for mobile broadband, prices for spectrum will go up and market mechanisms will help move spectrum to mobile broadband use. On the other hand, if the market demands less than that amount, prices may fall and less bandwidth will be made available for mobile broadband.[171]

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167. NBP, *supra* note 1, at 84.

168. *See id.* at 84–85.

169. *See id.*

170. *See id.* at 85 ("In other cases, the most expedient path to repurposing spectrum to broadband may be to use incentive auctions or to take other steps to energize the secondary markets for a particular band.").

171. *Id.* (emphasis added).

Leaving the market as the ultimate arbiter, as this statement suggests, would of course be perfectly consistent with the reform consensus. On the other hand, the Plan states clearly that if Congress were to refuse to give the FCC authority to conduct "incentive auctions," it would go forward with administrative reallocation and "conduct an auction of some or all the reallocated spectrum in 2012."[172] Similarly, the Plan promises to resort to other spectrum efficiency alternatives "if the incentive auctions do not yield a significant amount of spectrum . . . ."[173]

At the end of the day, the determination of how much spectrum will be reallocated, from which uses to which alternative uses, over what period of time, and so forth, will be decided by various rulemakings; the NBP's repeated endorsement of market-based approaches suggests such reforms will be considered.[174] What is less clear is how aggressively the FCC will pursue such reforms and whether, ultimately, it will be prepared to rely on the market as the ultimate arbiter of whether spectrum is actually being deployed to its highest value use.[175]

B. Privatizing Government Spectrum

The largest single holder of spectrum in the United States is the federal government which, according to NTIA, holds 14.1 percent of spectrum in the "beachfront" bands below 3.1 GHz on an exclusive basis, and an additional 54.2 percent on a shared basis.[176] There is widespread agreement that, despite years of reform efforts, much of this spectrum is either underutilized or utilized inefficiently, and that spectrum should be reallocated from federal to private use through auctions, leases, or spectrum sharing arrangements. Despite various efforts at reform, including passage, in 2004, of the Commercial Spectrum Enhancement Act ("CSEA"),[177] efforts to release more government spectrum into the marketplace have

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172. *Id.* at 92.

173. *Id.*(citation omitted).

174. In particular, the NBP calls for an internal review of secondary markets to be completed by the end of 2010. *See id.* at 83; *see also id.* at 90 ("The preference is to establish a voluntary, market-based mechanism to effect a reallocation, such as the incentive auctions described previously in this chapter.").

175. In another relevant passage, the NBP seems to suggest that administrative reallocation is a last-ditch tactic for achieving greater flexibility. *Id.* at 79 ("[T]he government's ability to reclaim, clear and re-auction spectrum (with flexible use rights) is the ultimate backstop against market failure and is an appropriate tool when a voluntary process stalls entirely."). What is not clear is how the FCC would determine whether reallocation had "stalled" because of some sort of market failure, as opposed to simply because the market has revealed that further reallocations would not be efficient.

176. *See* SPECTRUM POLICY INITIATIVE PLAN, *supra* note 40, at 4.

177. H.R. 5419, 108th Cong. (2004).

been cumbersome, slow, and only partially successful.[178] As a result, government agencies are the largest single source of spectrum that could be allocated to more productive uses.

The NBP makes three specific recommendations with respect to government spectrum. First, as noted above, the Plan calls for development of a "spectrum dashboard," which would provide information on the licensing and use of all spectrum in the United States; it specifically recommends that "NTIA should develop similar information on federal spectrum operations . . . should be made accessible through common links, with the intent of providing users a comprehensive view of combined FCC and NTIA information."[179] The availability of such information about government-allocated spectrum would be a significant step forward, as this information has heretofore never been publicly available in an easily accessible form or, in many cases, at all.[180]

The Plan's second proposal with respect to government-allocated spectrum is to strengthen the Commercial Spectrum Enhancement Act, which establishes a Spectrum Relocation Fund that allows spectrum auction proceeds to pay the costs of relocating federal services when spectrum is reallocated to nonfederal use.[181] The NBP calls for expanding

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178. *See* SPECTRUM POLICY INITIATIVE PLAN, *supra* note 40, at 19 ("Although NTIA's spectrum management processes stress efficient and effective use of the spectrum, NTIA conducts limited oversight. It trusts each agency to ensure that their systems are the most spectrum efficient practicable. NTIA conducts general reviews of new systems and reviews agency performance in the normal frequency assignment coordination process. However, NTIA has generally left to agencies decisions regarding whether a system uses spectrum appropriately or whether needs can be satisfied using a commercial service or a nonspectrum technology[.]"). *See also* UNITED STATES GENERAL ACCOUNTING OFFICE, SPECTRUM MANAGEMENT: BETTER KNOWLEDGE NEEDED TO TAKE ADVANTAGE OF TECHNOLOGIES THAT MAY IMPROVE SPECTRUM EFFICIENCY 3 (2004), http://www.gao.gov /new.items/d04666.pdf ("While NTIA is responsible for managing the federal government's use of spectrum and ensuring spectrum efficiency, NTIA primarily relies on individual agencies to ensure that the systems they develop make as efficient use of the spectrum as possible. Agencies' guidance and policies, however, do not require systematic consideration of spectrum efficiency in their acquisitions. The lack of economic consequence associated with the manner in which spectrum is used has also provided little incentive to agencies to pursue opportunities proactively to develop and use technologies that would improve spectrum efficiency governmentwide.").

179. NBP, *supra* note 1, at 80 (citation omitted). *See also id.* at 99 n.31.(noting that the NTIA has agreed, in principle, with this recommendation).

180. *See* SPECTRUM TRANSPARENCY WORKING GROUP, FINAL REPORT 1, 6 (2010) ("NTIA maintains a Government Master File (GMF) of federal frequency assignments. It is not in the public domain due to both classified and FOIA-exempt information contained in it. However, the Interdepartment Radio Advisory Committee (IRAC) membership does have full access to it, enabling other federal agencies to understand federal frequency assignments.").

181. *See* NBP, *supra* note 1, at 82.

the types of costs that can be paid for out of the Spectrum Relocation Fund to include such items as planning and staff costs associated with relocation and the costs of using commercial services when agencies decide, rather than recreating government-owned and -operated systems, to instead rely on commercial services.[182] This proposal, which should reduce the bias government agencies would otherwise have to "self-provide" wireless services when procuring from a commercial service would be more efficient, comports fully with the market-oriented reform consensus.

The Plan's third major proposal for government-allocated spectrum is to allow the NTIA to impose spectrum fees on government spectrum users.[183] Some reform advocates support such fees, on the theory that they would force the government to face the on-budget costs of their spectrum usage. It is not entirely clear, however, that they would have the desired effect, since the ultimate effect would be that one agency (say, the Department of Defense) would make a "payment" to another (the Treasury Department). Whether Congressional appropriators would take such fees into account in balancing the resources made available to agencies is an open question; it seems highly unlikely, in any case, that the effect would bear any close relationship to true economic (as opposed to political) benefits and costs.

Reform advocates have proposed additional steps that might be taken to encourage federal agencies to free up underutilized spectrum. For example, Congress should consider applying the model of the Base Closing and Realignment Commissions ("BRAC") that have been successful in closing and consolidating unnecessary military bases to the problem of federal spectrum. Since first employed in 1988, four BRAC commissions have recommended the closure or realignment of dozens of military bases, resulting in more than $17 billion in one-time savings and annual savings of more than $7 billion.[184] While the challenges facing federal spectrum management are not identical to those in the base-closing context (e.g., individual members of Congress are not likely to defend agency spectrum allocations quite as vociferously as they are local military bases), the

182. *See id.* ("In particular, Congress should revise the CSEA to provide for payments of relocation funds to federal users that vacate spectrum and make use of commercial networks instead of alternative dedicated federal spectrum. Expanding the definition of reimbursable costs to include a federal incumbent's costs incurred to obtain telecommunications services from another existing network will promote agency use of shared commercial infrastructure, thereby freeing federal spectrum to be licensed for broadband deployment.").

183. NBP, *supra* note 1, at 82.

184. *Base Realignment and Closure 2005: Frequently Asked Questions*, UNITED STATES DEPARTMENT OF DEFENSE, http://www.defense.gov/brac/faqs001.html (last visited Nov. 15, 2011).

BRAC model would nevertheless have obvious advantages. Most significantly, it would create a focal point and an independent analytical process for identifying excess spectrum, and help to overcome political opposition to transitioning agencies away from patterns of inefficient spectrum use.[185]

Another approach would be to strengthen the role of the Office of Management and Budget ("OMB") in identifying and bringing to market unused or underutilized federal spectrum, as part of the process of preparing and proposing the President's Budget. OMB should be tasked to conduct an annual review of federal spectrum use, under which agencies would be required to justify their spectrum holdings and identify spectrum that might be available for auction, lease, or sharing arrangements. Revenues resulting from this process should be included in the President's Budget, as well as in each Congressional budget resolution. Doing so would rebalance the incentives of individual agencies (which—no matter how many "fees" they are required to "pay" to the Treasury—ultimately have little or no stake in the budget consequences of privatizing their spectrum) against the incentives of the OMB and the Congressional committees primarily responsible for fiscal responsibility, as well as the incentives of taxpayers.

C. Other Policy Goals

Under the command and control model, regulators have often utilized license restrictions and other spectrum policy tools to pursue policy objectives that are not directly related to the efficient allocation of spectrum per se, or which could better be pursued through other means. The best examples of such policies are the use of spectrum caps, license conditions, bidding credits, spectrum fees, build-out requirements, and similar tools designed to prevent "hoarding," foster more competitive market structures, or promote efficient use of spectrum.[186] Some of these policies, such as spectrum caps, though de-emphasized in recent years may be on the rise;[187] others, such as license conditions, remain very much in vogue.[188]

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185. *See* GOVERNMENT ACCOUNTABILITY OFFICE, HIGHLIGHTS: COMPREHENSIVE REVIEW OF U.S. SPECTRUM MANAGEMENT WITH BROAD STAKEHOLDER INVOLVEMENT IS NEEDED 1, (2003), http://www.gao.gov/new.items/d03277.pdf ("While active dialogue among key stakeholders is ongoing, differing priorities have led to little consensus on appropriate reforms. In addition, the current spectrum-management structure—with multiple agency jurisdictions and a slow decision-making process—has hindered consideration of whether fundamental reform is needed. In the past, commissions – such as the Defense Base Closure and Realignment Commission—have been used to look at major policy change when complex problems arise.").

186. *See* Comments of 37 Concerned Economists, *supra* note 13, at 5–6.

187. Spectrum limits have been de-emphasized, but not eliminated. For example, the

Such policies may have made sense when spectrum was both scarce and assigned by administrative fiat, but in a market-oriented system characterized by spectrum abundance, their benefits are reduced and their costs increased. A core principle of the spectrum reform consensus is that such policies should, as a general matter, be avoided.[189]

On most of these issues, the NBP appears to be at least partially at variance with the reform consensus. It proposes spectrum fees on private licensees,[190] embraces "construction benchmarks,"[191] promotes the notion of utilizing auction revenues to support new government spending programs, and hints that spectrum allocation decisions should be made on the basis of promoting entry or increasing the prevalence of "small businesses" in the wireless business.[192]

Concerns that the FCC might use its control over spectrum to embark on an "industrial policy" approach to change the market structure of the mobile wireless business were heightened by its decision in *Skyterra*, adopted only a few weeks after the NBP was released, to limit the ability of the two largest wireless carriers, by revenues, not by spectrum, to lease the MSS/ATC spectrum,[193] and by its refusal, in its 14th annual report on competition in the CMRS marketplace, to repeat previous findings that the market is "effectively competitive."[194]

The spectrum reform consensus does not, of course, endorse the accumulation of market power in the mobile wireless market (or any other market). Indeed, at least some reform advocates suggest that market power is an appropriate consideration for the allocation of spectrum to private actors.[195] However, reform advocates also note that flexibility and

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FCC continues to rely on a spectrum threshold in its review of CMRS mergers, despite the fact that its thresholds do not appear to be justifiable as a matter of competition policy. *See, e.g.*, Michael Katz, "An Economic Analysis of the Spectrum Component of the Federal Communications Commission's Merger Review Screen," (August 19, 2008).

188. *See* Skyterra Communs., *Memorandum Opinion and Order and Declaratory Ruling*, 25 F.C.C.R.. 3059 (2010) [hereinafter *SkyTerra Order*].

189. *See* Comments of 37 Concerned Economists, *supra* note 13*,* at 5–6.

190. NBP, *supra* note 1, at 82.

191. *Id.* at 88.

192. *Id.* at 78 ("Additional spectrum is also required to accommodate multiple providers in a competitive marketplace, including new entrants and small businesses, as well as to enable wireless services to compete with wireline services.").

193. *See Skyterra Order*, *supra* note 188, at 3088–89.

194. Implementation of Section 6002(B) of the Omnibus Budget Reconciliation Act of 1993, Annual Report and Analysis of Competitive Market Conditions with Respect to Commercial Mobile Services*, Fourteenth Report*, 25 F.C.C.R. 11407, para. 16 (2010).

195. *See* Comments of 37 Concerned Economists, *supra* note 13, at 5 ("The Commission should eliminate all requirements that are not related to interference or anti-competitive concentration.").

secondary markets tend to ameliorate market power concerns, if not eliminate them altogether,[196] and argue that, rather than attempting to micromanage the distribution of spectrum through *ex ante* regulation, spectrum policy should rely on traditional antitrust law and *ex post* enforcement.[197] Most importantly, most reform advocates note that wireless markets in the United States—especially those characterized by high degrees of spectrum flexibility and secondary market trading—are highly competitive.[198]

V. CONCLUSION

The National Broadband Plan has performed a tremendous service by raising awareness among policymakers and the public at large of the importance of spectrum allocation policies, the costs current policies are imposing on consumers and the economy, and the opportunities associated with reform. Although the Plan stops short of fully embracing the market-oriented spectrum reform consensus that began with Ronald Coase, the reforms most economists and many policymakers—of all ideologies and political stripes—have advocated for nearly two decades, it nevertheless pays homage to, and in many cases advances, the principles of spectrum flexibility and tradability that have formed the basis of this consensus. As it moves ahead to implement its many recommendations through rulemakings, the FCC will make innumerable choices that will determine whether, in the end, the NBP results in reforms that allow spectrum to flow more rapidly to its highest value use.

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196. *See* Martin Cave, Remarks at the Improving Spectrum Management through Economic or Other Incentives Workshop: International Experiences in Market-Based Approaches (Mar. 1, 2006), www.ntia.doc.gov/files/ntia/publications/spectrumworkshop_030106.pdf ("Now if there are all sorts of different ways to market in those downstream activities, both wire based and in spectrum terms using a whole bunch of different frequencies which potential operators are now entitled to use subject to liberalization, then you should see these spectrum markets widening and the opportunity for anybody actually to hoard spectrum, to corner markets, to exclude competitors by denying them access to this essential in put [sic], that should be with the passage of time sort of go out the window."); *see also* Crocioni, *supra* note 44, at 457 ("In spectrum markets . . . empirical work shows that spectrum trading and liberalisation [sic] in Guatemala and El Salvador have led to less concentrated mobile markets.") (citation omitted).

197. *See* CAVE, *supra* note 43, at 18–19 ("As with other markets, trading of spectrum could potentially enable one or more operators to gain and abuse dominance in the spectrum market or in a 'downstream' market, which uses spectrum as an input. Government needs to be vigilant against such an outcome, but should deploy the same competition policy tools in spectrum trading as it does for other input markets. This should be subject to the general competition regime, relying on an *ex post* analysis of the impact of spectrum trading on competition in defined markets.").

198. *See, e.g.,* Ehrlich, *supra* note 90, at 7–13.