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COORDINATING THE OFFSHORE ENERGY TRANSITION: A LEGAL ECONOMIC FRAMEWORK

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INTRODUCTION

This Article cautions against the uncoordinated introduction of technology into the offshore energy sector and instead proposes the preemptive introduction of a patent platform to prevent market failure.[1] "Offshore energy" as used in this Article, refers to: 1) offshore hydrocarbon acquisition (oil and natural gas); and 2) offshore renewables installation (such as offshore solar platforms, ocean energy, and wind farms). In 2015, the offshore hydrocarbon industry produced roughly thirty percent of the ninety million barrels of oil the world consumed *each day*, and that percentage remains largely unchanged.[2] While offshore hydrocarbon acquisition presently dominates offshore energy, renewables are the fastest growing source of electricity generation.[3] Accordingly, any future disruption to either sector may have dramatic consequences for the world, and United States' economies.

Economic pressures already require costs for *both* hydrocarbon acquisition and renewables installation to decline.[4] Analysts expect that these reductions

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[1] *See infra* notes 127, 128, 130 and accompanying text. As discussed below, ACORE, API, and NOIA are all well positioned to determine when the proposed solution would be timely and effective.

[2] Oil & Gas 360, *Offshore Oil Accounted For 30% Of Global Output In 2015*, OILPRICE.COM (Oct. 26, 2016), http://oilprice.com/Energy/CrudeOil/OffshoreOilAccountedFor30OfGlobalOutputIn2015.html [https://perma.cc/BXQ8-U9JC]; U.S. ENERGY INFORMATION ADMINISTRATION, SHORT TERM ENERGY OUTLOOK Table 1 (2017), http://www.eia.gov/outlooks/steo/pdf/steo_full.pdf [https://perma.cc/4W7Z-6KAD]; *FACTBOX-Offshore increasingly important to oil industry*, REUTERS OIL REPORT (July 6, 2010) http://uk.reuters.com/article/oil-offshore-idUKLDE6640YV20100706 [https://perma.cc/ZK7Q-LC2T]; *See also*, Sue Goodridge, *How Offshore and Onshore Drilling Perform when Oil Prices Tumble*, MARKET REALIST, http://marketrealist.com/2016/02/offshore-onshore-drilling-perform-oil-prices-tumble/ (Feb. 1, 2016) [https://perma.cc/V2K9-FEHR] ("Traditional onshore drilling is cheaper than offshore drilling, but the overall cost of unconventional onshore oil is on par with or exceeds offshore drilling costs.").

[3] U.S. ENERGY INFORMATION ADMINISTRATION, INTERNATIONAL ENERGY OUTLOOK 2016: WITH PROJECTIONS TO 2040 1 (2016), http://www.eia.gov/outlooks/ieo/pdf/0484(2016).pdf [https://perma.cc/22MJ-P8YP] ("Renewables are the world's fastest-growing energy source over the projection period. Renewable energy consumption increases by an average 2.6%/year between 2012 and 2040.").

[4] *Technology and Innovation Key to Cost Reduction and Capital Efficiency as Companies Strive to Meet Future Energy Demand, IHS Says*, IHS MARKIT, http://news.ihsmarkit.com/press-release/bp-technology-review/technology-and-innovation-

will mostly follow from technical innovations.[5] Unfortunately, diversified and uncoordinated innovation can itself *increase* costs via patent thickets, royalty stacking, and failures to standardize interoperating systems.[6] Inefficiencies from this uncoordinated innovation are especially likely to appear unexpectedly in the offshore energy sector for at least three reasons. First, as the industry transitions from a handful of "supermajors" to a more diversified ecosystem including renewables, interests and patent portfolios will diversify.[7] Second, the legal framework applicable offshore superficially appears to mitigate patent liability when, in fact, patents have the ability to extend their influence well beyond their jurisdictional boundaries.[8] Third, hydrocarbons and renewables

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key-cost-reduction-and-capital-efficien (Dec. 1, 2015) [https://perma.cc/VH47-72SQ] ("As persistent low oil prices take their toll on both industry profits and spending projections, oil and gas operators are turning, in part, to technology and innovation to reduce costs and increase capital efficiency in the short-term, while aiming to meet increased future energy demand in a low carbon environment"); *See also* Joshua Hill, *Cost Reductions & Dynamic Polices Drive Renewable Energy Growth In Latin America*, CLEAN TECHNICA, https://cleantechnica.com/2016/11/18/cost-reductions-dynamic-polices-drive-renewable-energy-growth-latin-america/ (Nov. 18, 2016) [https://perma.cc/JTG8-EXH9]("A combination of rapid technology cost reductions and the consolidation of renewable energy policies have served to help Latin America become home to some of the world's most dynamic renewable energy markets, and resulted in 'an unprecedented opportunity' for the region to accelerate the uptake of renewable energy across all sectors.").

[5] *Id.*

[6] "Patent thickets" are portfolios of patents that, individually, may not foreclose development in a technical area, but in aggregate, render it impossible or uneconomical to do so without infringing. Adam Mossoff, *The Rise and Fall of the First American Patent Thicket: The Sewing Machine War of the 1850s*, 53 Ariz. L. Rev. 165, 166–67 (2011) (describing patent thickets). "Royalty stacking" occurs when otherwise reasonable royalties for individual components, in aggregate, make development of a system as a whole uneconomical. Gregory Sidak, *Holdup, Royalty Stacking, and the Presumption of Injunctive Relief for Patent Infringement: A Reply to Lemley and Shapiro*, 92 Minn. L. Rev. 714 (2008) (describing royalty stacking). The consequences of standards setting failures are discussed in greater detail, *see infra* Part II. *See also* Jorge L. Contreras, *Fixing Frand: A Pseudo-Pool Approach to Standards-Based Patent Licensing*, 79 Antitrust L.J. 47, note 105 (2013) (arguing that patent pools are effective at eliminating royalty stacking).

[7] *See, e.g.*, JOSEPH A. PRATT ET AL., OFFSHORE PIONEERS: BROWN & ROOT AND THE HISTORY OF OFFSHORE OIL AND GAS (1997). There have certainly been many technical achievements in offshore hydrocarbon history. Many of these innovations directly anticipated price fluctuations. However, the increased automation, introduction of renewables, introduction of fracking and horizontal drilling, and tighter network economy, present unique challenges as compared to the past.

[8] Cyrus Sanati, *The End of Big Oil?*, FORTUNE (Aug. 1, 2011) http://fortune.com/2011/08/01/the-end-of-big-oil/ [https://perma.cc/RCJ7-RVHN]("Up until now, it was widely accepted that being bigger was the key to being a better oil company-

are not complete substitutes, but often serve complementary functions. This complementarity can increase the likelihood of patent holdup and inefficient technical adoption, as it provides rent seekers leverage in multiple markets and complicates inter-industry coordination.

Such a technology ramp-up and subsequent holdup has precedent in the development of the American railroad, referenced extensively herein, which also felt economic pressures to innovate while straddling interdependent markets.[9] Unlike the American railroad, however, the brittle and volatile offshore energy markets cannot easily shoulder cost overruns.[10] Accordingly, once economic conditions warrant substantial investment in offshore energy infrastructure, this Article suggests that the offshore community consider implementing a properly organized patent platform to proactively remediate patent holdup *prior* to engaging in such substantial investment.

Section I of this Article provides an overview of the existing offshore energy markets and the relevant legal frameworks in the United States. Section II then provides a description of a "patent platform", a legal tool that may facili-

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False Contrary to popular belief, Big Oil has almost no control over the price of oil these days. That power squarely rests with oil-rich nations that hold most of the world's oil reserves and the Wall Street banks and hedge funds that speculate and make markets in the oil trading game False Investors who wanted exposure to the oil and gas sector noticed this disconnect. As they put more money in the smaller, pure-play companies that focused on one industry vertical, Big Oil began to trade at a discount."). Indeed, analysts regularly complain that exploration, acquisition, and refinement, while benefiting from coordination, have little need for a single corporate structure (see the vertical sectors identified in Figure 1)).

[9] STEVEN W. USSELMAN, REGULATING RAILROAD INNOVATION, BUSINESS, TECHNOLOGY, AND POLITICS IN AMERICA, 1840-1920, 128-29 (2002). The railroads repeatedly failed to adopt cost-saving technologies, such as the telegraph, in a timely and coordinated manner ("[R]ailroads did not utilize the [telegraph in] their own operations for at least another seven years [after telegraph companies ran wire along their rights-of-way"). The railroads were often reactive, failing to impose standards for technology adoption to avoid patent thickets ("When Perkins took over Harris and inquired in 1878 about who supplied the Burlington with crossing gates and manual signals, he was alarmed to learn that employees on different parts of the system had been left to purchase their personal favorites."). As discussed above, this lack of coordination is unacceptable in the offshore energy industry. In some ways, other industries, such as telecommunications, bear important lessons for the energy sector, but the richness of the railroad history and space constraints have focused the comparison primarily on Usselman's work, which identifies most of the salient, recurring themes.

[10] To summarize these specific similarities, the industries share a fundamental tension between efficiency and innovation. Like the offshore oil industry before today, the American railroads did not originally anticipate or proactively address this tension because high demand and subsidization made it unnecessary to do so. While the tension is ever present in all industries, offshore energy's importance to the world economy and its sensitivity to unexpected costs make it especially important to proactively address the issues.

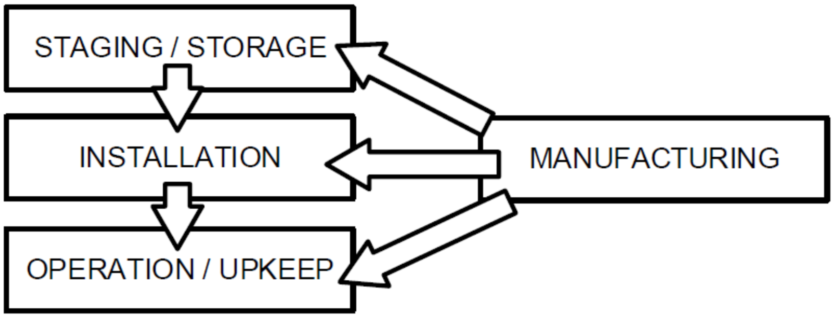
tate more elegant technology adoption in the offshore energy sector. Finally, Section III briefly describes aspects of a hypothetical patent platform architecture that may alleviate these pressures on the offshore energy industry. While this Article addresses the offshore transition specifically, one will recognize that many of the insights may apply to other industries.[11] Similarly, while this Article primarily considers offshore activities as their legal issues are less readily apparent, one will recognize counterparts in onshore energy, *mutatis mutandis*.[12]

I. OFFSHORE ENERGY OVERVIEW AND LEGAL FRAMEWORK

The emerging offshore energy industry is exceptionally complicated and presently inchoate. Accordingly, this section serves merely as a general overview to orient the reader. Section A summarizes the offshore energy industry's topology. Section B then explains the jurisdictional factors facilitating a patent holdup. Finally, Section C discusses the market factors likely to precipitate future patent holdup and standardization inefficiencies.

A. Offshore Energy Topologies

Both offshore hydrocarbon acquisition and offshore renewables share a common industry structure comprising, very roughly, four stages, organized as illustrated in Figure 1.



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[11] The Author focuses upon offshore energy mostly because the consolidation, higher costs, and stronger technology dependence involve more difficult legal problems (see the jurisdiction discussion below). In practice, if industry members considered a platform beneficial to the offshore industry, they'd likely extend its scope to encompass onshore activities.

[12] For example, one would need to consider local regulations, price controls, etc. in both communities.

FIGURE 1: Offshore Energy Industry Vertical Segments

During the "Staging/Storage" segment, developers identify a suitable location for installation as well as onshore resources to facilitate that installation and future maintenance. Developers may rent or construct facilities and secure services necessary to perform installation. During the "Installation" segment, developers tow the necessary parts from the staging location and install them. Once installed, during the "Operation / Upkeep" segment, operators and service providers replace parts, service systems, and take steps to ensure the continued operation of the system. Each of "Staging/Storage", "Installation", and "Operation / Upkeep" may be performed by subsidiaries, contractors, or a single entity. Each of "Staging/Storage", "Installation", and "Operation / Upkeep", may also involve methods and hardware amenable to patent protection (though subject to jurisdictional issues outlined below). The "Manufacturing" segment, plays a special role, as every other segment depends upon specially manufactured components to accomplish their respective objectives. Naturally, such components are also susceptible to patent protection in their construction, form factor, and use.

Figure 2 illustrates aspects of these vertical segments in the offshore hydrocarbon acquisition industry.

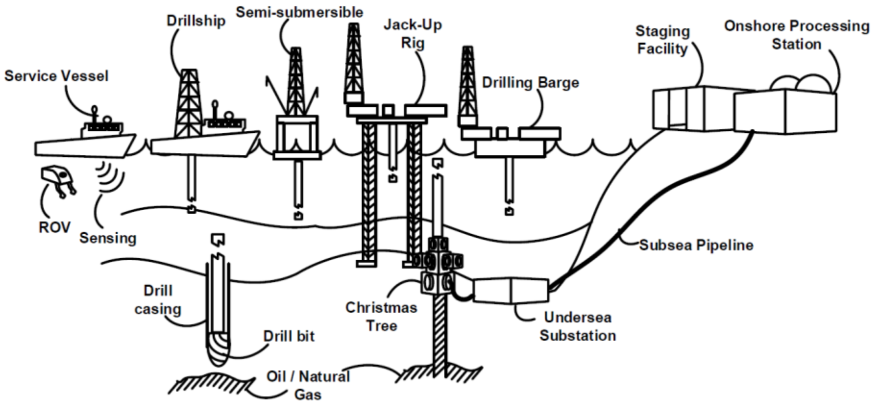

FIGURE 2: Abstracted Offshore Hydrocarbon Acquisition Topology

Initially, during Staging, a service vessel may map the seafloor to identify likely oil plays. Exploratory drill ships or barges may then assess the more favorably identified plays. Once a suitable location has been found, operators may construct or prepare a rig for Installation at a staging facility. Rigs come in many varieties, such as drill ships, semi-submersibles, barges, jack-up rigs, etc. Once operators install the rig, they may drill into the reservoir using a plurality of drills and drill casings. Operators may also place various equipment on the seafloor and erect secondary structures to facilitate oil extraction, such as substations, below and above the surface. Operators may install valves (e.g., a "Christmas tree" system above the wellhead) and other systems to manage hydrocarbon flow. Subsea pipelines (possibly previously installed) may also be used to direct the hydrocarbons to an onshore processing facility. Thus, Operation may involve not just maintaining the rig, but maintaining this orchestrated ecosystem of subsystems. To this end, operators may use Remotely Operated Vehicles (ROVs) and various service vessels to ensure pipeline integrity, proper installation, maintenance, etc. These are especially active fields of technical innovation, with many ROV and rig operations likely to be automated and unmanned in the future. Manufacturing is pervasive throughout the industry, affecting the construction of installation vessels, drill equipment, ROV hardware, etc.

Offshore renewables employ a similar topology to offshore hydrocarbons, as depicted in FIG. 3.

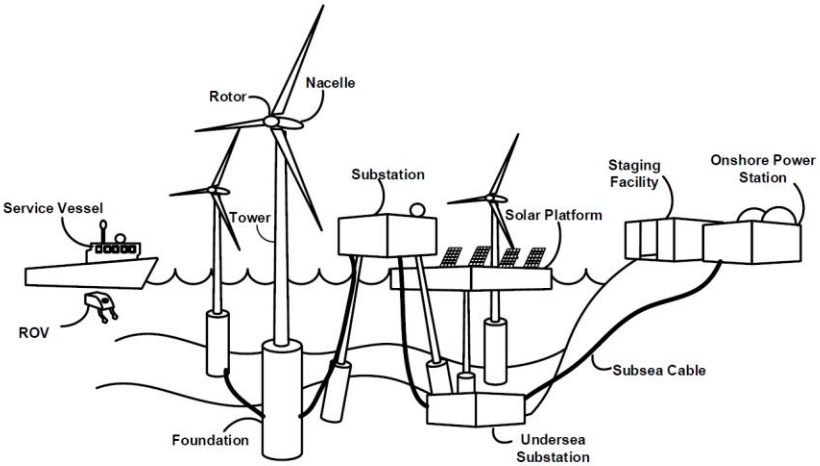

FIGURE 3: Abstracted Offshore-Renewables Topology

Again, during Staging, a service vessel and other sensor systems may first map the seafloor and surface conditions to identify suitable installation locations. Like some drill ships, some offshore renewable platforms are not anchored to the ocean floor, and so the survey ship may assess the conditions of the wind and water flow. Once operators identify a suitable location, they may also lease or construct suitable onshore Staging facilities. Once Staging is in order, Installation of the renewable platform may begin.[13] Once the renewables

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[13] While skepticism exists in the Executive Branch regarding offshore wind, bidding is

platform has been installed, various equipment may be added to the seafloor to facilitate electricity extraction. For example, each of offshore wind, offshore solar, and subsea current systems may transmit their electrical current via a High Voltage Direct Current (HDVC) subsea cable system to an intermediary substation (below or above surface) and subsequently to an onshore power station. Similar to oil, ROVs and service vessels may be used throughout the process to ensure cable integrity, proper installation, maintenance, etc. Like hydrocarbons, many ROV and rig operations will likely be automated and unmanned in the future (indeed, many of the same service providers servicing one industry will likely service the other). While offshore wind farms avoid many of the onshore issues (obstruction of views, lowers winds, etc.) they cost much more to install.[14] Indeed, the United States has only a single offshore wind farm presently installed (Europe and Asia, in contrast, have taken to the technology much more quickly).[15]

Like hydrocarbon acquisition, "Manufacturing" for renewables similarly affects all other segments of the industry. As discussed below, this is very important from a patent enforcement perspective as patents may influence manufactured components long after they have left US shores.[16]

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presently taking place for a new farm off the coast of New York. *See, e.g.,* Tatiana Schlossberg, *America's First Offshore Wind Farm Spins to Life*, N.Y. TIMES, Dec. 15, 2016*,* at A15; *see also* Justin Gillis, *Weak Federal Powers Could Limit Trump's Climate-Policy Rollback,* N.Y. TIMES, Jan. 3 2017, at D1. Government subsidies can be easily abused and so some skepticism is certainly warranted. As discussed herein, the technical challenges confronting renewables are non-trivial (indeed, nuclear sometimes appears a more economical alternative). However, the pressures confronting the offshore energy are real, and so this paper assumes that industry members will respond with technical innovation, if not exactly as predicted herein, then in a similar manner warranting coordinated cost reduction.

[14] *See* Ryan H. Wisner et al., 2015 WIND TECHNOLOGIES MARKET REPORT, LAWRENCE BERKELEY NATIONAL LABORATORY (August 2016) at 10 https://emp.lbl.gov/sites/all/files/2015-windtechreport.final_.pdf.. With subsidization, politics, economics, national security, environmental, and property issues intermingled, sober appraisals of *any* energy technology, existing or planned, are hard to come by.

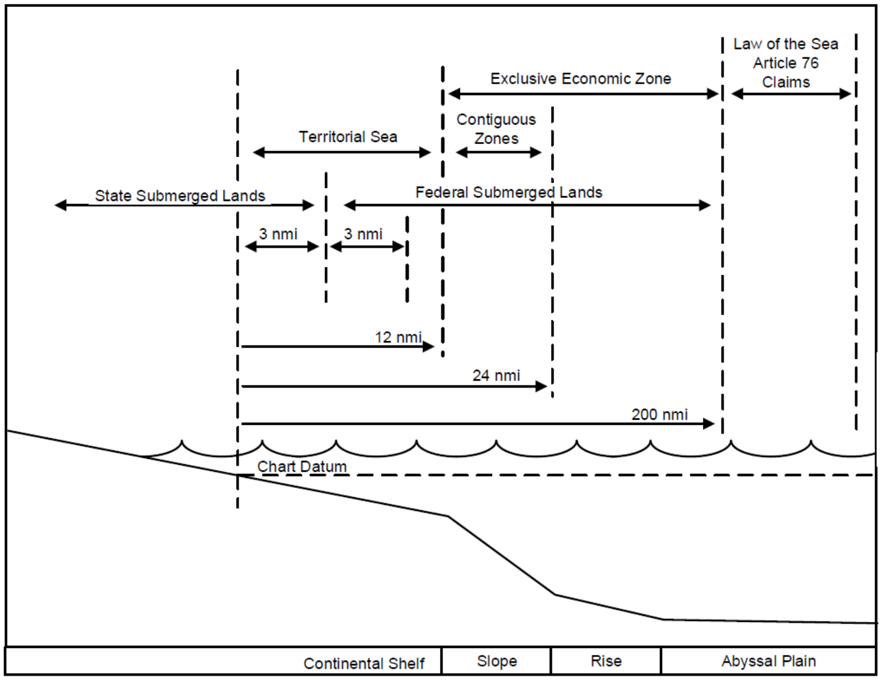
[15] *See* Schlossberg, *supra* note 12.

[16] Coincidentally, wind turbine lifetime is roughly commensurate with patent term: ~20 years. *See* Robert Mendick, *Wind Farm Turbines Wear Sooner than Expected, Says Study*, THE TELEGRAPH (Dec. 30, 2012), www.telegraph.co.uk/news/earth/energy/windpower/9770837/Wind-farm-turbines-wear-sooner-than-expected-says-study.html [https://perma.cc/6XKM-NYCY] ("The wind energy industry and the Government base all their calculations on turbines enjoying a lifespan of 20 to 25 years.").

B. Jurisdiction for Patent Enforcement

Historically, offshore technology has not been a heavily litigated area.[17] However, if offshore activities diversify with the introduction of renewables and a more technology-based focus to competition, this reluctance to litigate will likely change, as it did for the railroads.[18] Offshore service providers may find themselves unprepared for this transition, not only because patents have played little role in the past, but because offshore jurisdiction belies the influence patents can have upon offshore activity.

Figure 4 illustrates the jurisdictional regions relevant to offshore patent enforcement.



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29 U.S. 1 (1946); Transocean Offshore Deepwater Drilling, Inc. v. Maersk Contractors USA, Inc., 617 F.3d 1296 (Fed. Cir. 2010); WesternGeco L.L.C. v. Ion Geophysical Corp., 776 F.Supp.2d 342 (S.D. Tex. 2011). Despite their paucity, some hydrocarbon cases have still precipitated seminal statutory reform, as in the case of *Halliburton*, which precipitated statutory reform for "means for" claiming as found in 35 U.S.C. 112 sixth paragraph. *Halliburton*, 329 U.S. at 1.

[18] Historically, the problem first arises when a rent-seeker recognizes that adopters have not coordinated their adoption of a cost-cutting technology. In the railroads, the "Tanner case" for double acting air brakes offers a quintessential example, where no matter how many licensing deals railroad operators concluded, there always seemed to be just one more asset the licensor had failed to mention necessary for complete freedom to operate. *See* USSELMAN, *supra* note 9 at 108-10.

FIGURE 4: Offshore Jurisdiction Breakdown (N.B., not to scale)[19]

While not extensively litigated, as far as patents are concerned, US courts appear to have jurisdiction only over activities occurring in the "territorial sea."[20] These waters extend merely 12 nautical miles from the shore. Beyond these waters, the "contiguous zone" extends for another 12 nautical miles,[21] which itself forms part of the "Exclusive Economic Zone" (EEZ). The EEZ is a resource rich area extending 200 miles from shore, collectively forming an area 1.5 times the surface area of the United States.[22] Infringing activities occurring in *both* the contiguous and territorial zones may be subject to jurisdiction (e.g., when a ship operator begins using an infringing cable reel in the contiguous zone and concludes doing so in the territorial zone). While the US does have sovereign rights in economic exploitation of the EEZ's natural resources, the only court to discuss the matter did not find jurisdiction in the EEZ for patent enforcement.[23] As many offshore activities occur further than 12 nautical miles from shore, this would seem to imply that patents play little role in the offshore market. For example, communities pressure many operators to place offshore wind farms further than 12 nautical miles from shore to avoid affecting seaside views. Similarly, foreign vessels, from foreign ports, may install oil rigs without ever entering territorial waters.[24]

However, it is important to note the preceding paragraph's emphasis on "activities." *Activities performed* outside the territorial waters are not subject to

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[19] Adapted from graphic "Photo 70" appearing on the NOAA website. Pursuant to 17 U.S.C. § 105, that graphic acquired from the Nation Oceanic and Atmospheric Agency is not subject to copyright protection. 17 U.S.C. § 105 (1976); NOAA, MARITIME ZONES AND BOUNDARIES, http://www.gc.noaa.gov/gcil_maritime.html [https://perma.cc/P2EU-7SUY]. This derivative work, however, is © James Skelley.

[20] WesternGeco L.L.C. v. Ion Geophysical Corp., 776 F.Supp.2d 342, 365 (S.D. Tex. 2011) ("[T]he United States possesses complete sovereignty over the territorial sea—a belt of sea that extends no more than 12 miles seaward of the baseline of the coastal state.").

[21] *Id.* at 366 ("[T]he United States possesses limited policy rights within the contiguous zone—a belt of sea contiguous to the territorial sea, which extends up to 24 miles seaward of baseline from which the territorial sea is measured.").

[22] *Id.* ("[T]he United States possesses sovereign rights in economic exploitation of natural resources and jurisdiction over marine scientific research within the Exclusive Economic Zone (''EEZ'')—a belt of sea that extends no more than 200 miles seaward of the baseline from which the breadth of the territorial sea is measured.").

[23] *Id.* at 370 ("Thus, we find that the Fugro Norway Defendants' activities in the EEZ do not occur within the territory of the United States for purposes of U.S. patent law.").

[24] Outer Continental Shelf Lands Act (OCSLA), 43 U.S.C. 1302 (1953).

US Court jurisdiction. *Manufactured components* on the other hand, are a different matter. 35 U.S.C. § 271 permits an action for infringement whenever one "*makes*, uses, or *sells*" an infringing article, "*induces* infringement" by another of an infringing article, or "*offers to sell* or sells within the United States or *imports* into the United States"[25] an infringing article.[26] This jurisdictional control over manufactured articles especially has the potential to influence offshore development as evidenced by the intimate relationship to manufacturing depicted in FIG. 1. Indeed, the limits of patent influence is a very active area of law, with various issues pending before the Supreme Court as of this writing.[27] Experienced patent drafters can readily avail themselves of this broader scope to capture various offshore innovations, whether those innovations take the form of a method, apparatus, or a combination of both.

In addition, rather than base jurisdiction on the court's admiralty power, statutes may provide federal courts with jurisdiction over offshore actions for patent-related activities. For example, the Outer Continental Shelf Lands Act (OCSLA)[28] provides jurisdiction over "devices permanently or temporarily at-

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[25] Transocean Offshore Deepwater Drilling Inc. v. Maersk Contractors USA, Inc., 617 F.3d 1296, 1308 (Fed. Cir. 2010) ("An offer to sell is a distinct act of infringement separate from an actual sale. An offer to sell differs from a sale in that an offer to sell need not be accepted to constitute an act of infringement."); *id.* at 1309 ("In order for an offer to sell to constitute infringement, the offer must be to sell a patented invention within the United States. The focus should not be on the location of the offer, but rather the location of the future sale that would occur pursuant to the offer."); *id.* at 1310 ("The fact that the offer was negotiated or a contract signed while the two U.S. companies were abroad does not remove this case from statutory liability.").

"Whoever without **authority imports into the United States or offers to sell, sells, or uses within the United States a product which is made by a process patented in the United States** shall be liable as an infringer, if the importation, offer to sell, sale, or use of the product occurs during the term of such process patent . . . "35 U.S.C. § 271(g) (2010) (emphasis added). Note that inducement requires an act of direct infringement within US territory. *See, e.g.*, Limelight Networks, Inc. v. Akamai Techs., Inc., 134 S.Ct. 2111, 2115 (2014) (stating that a defendant is not liable for inducing infringement under § 271(b) when no one has directly infringed under §271(a) or any other statutory provision).

[27] Lexmark Int'l, Inc. v. Impression Prod., Inc., 816 F.3d 721, 726 (Fed. Cir. 2016) (cert granted December 2, 2016) (addressing the limits of the patent exhaustion doctrine for foreign sales); Promega Corp. v. Life Techs. Corp., 773 F.3d 1338, 1354 (Fed. Cir. 2014) (cert granted December 2, 2016) (deciding whether supplying a single, commodity component of a multi-component invention from the United States is an infringing act under 35 U.S.C. § 271(f)(1).).

[28] 43 U.S.C. § 1333(a)(1) (1978). *See also*, 43 U.S.C. § 1331 (1978) ("The term "outer Continental Shelf" means all submerged lands lying seaward and outside of the area of lands beneath navigable waters as defined in section 1301 of this title, and of **which the subsoil and seabed appertain to the United States and are subject to its jurisdiction and con-**

tached to the seabed, or to devices or vessels meant to transport resources obtained from the seabed."[29] Assuming these limitations are met (as will often be the case for fixed drilling platforms, subsea stations, pipelines, etc.) the entire outer continental shelf region, illustrated in FIG. 5, will be susceptible to actions for infringement.

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trol.") (emphasis added). Other cases make clear that the OCSLA encompasses infringement claims when its requirements are met. *See, e.g.*, L.C. Eldridge Sales Co. v. Azen Mfg. Pte., No. 6:11-cv-599, 2013 U.S. Dist. LEXIS 186151 at *4 (E.D. Tex. Nov. 13, 2013) ("The Patent Act is a law of the United States extended through the OCSLA."); Tenn. Gas Pipeline v. Hous. Cas. Ins. Co., 87 F.3d 150, 154 (5th Cir. 1996) ("OCSLA was intended to apply to the full range of disputes that might occur on the [outer continental shelf] . . . . OCSLA not only defines the law applicable to the [outer continental shelf], but also grants federal courts jurisdiction over disputes occurring there.").

[29] *WesternGeco*, 776 F.Supp.2d at 371.

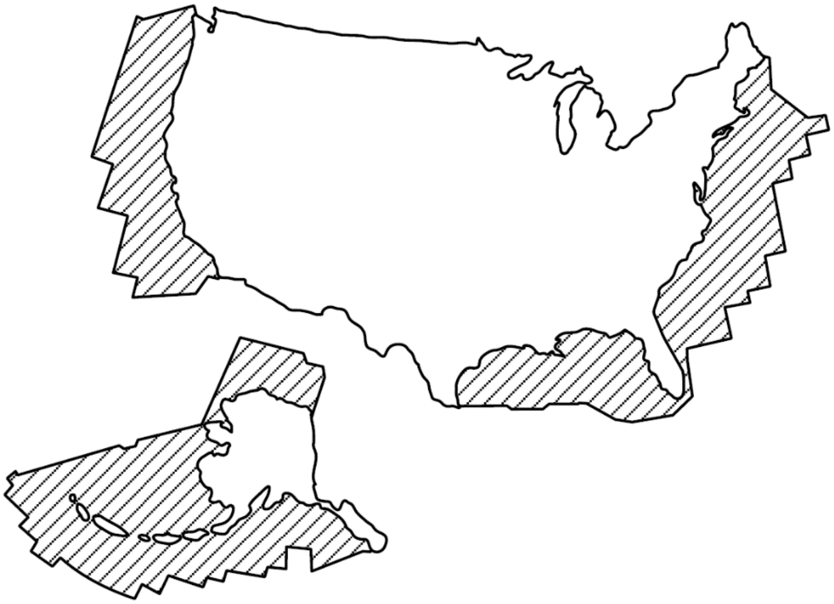

FIGURE 5: Outer Continental Shelf (N.B., Alaska not to scale)[30]

This is a very large region, approximately 75% the size of United States itself.[31]

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[30] Adapted from graphic "Federal OCS Areas of the United Sates." U.S. DEP'T OF THE INTERIOR MINERALS MGMT. SERVICE, ASSESSMENT OF UNDISCOVERED TECHNICALLY RECOVERABLE OIL AND GAS RESOURCES OF THE NATION'S OUTER CONTINENTAL SHELF, 2006 (Feb. 2006), https://www.boem.gov/uploadedFiles/2006_National_Assessment_Factsheet.pdf. [https://perma.cc/4GEL-4KWA]. Pursuant to 17 U.S.C. § 105, that graphic acquired from the U.S. Department of the Interior Minerals Management Service is not subject to copyright protection. 17 U.S.C. § 105 (1977). This derivative work, however, is © James Skelley.

[31] U.S. DEP'T OF THE INTERIOR MINERALS MGMT. SERVICE, ASSESSMENT OF UNDISCOVERED TECHNICALLY RECOVERABLE OIL AND GAS RESOURCES OF THE NATION'S OUTER CONTINENTAL SHELF, 2006 (Feb. 2006) https://www.boem.gov/uploadedFiles/2006_National_Assessment_Factsheet.pdf [https://perma.cc/4GEL-4KWA] ("Using a play-based assessment methodology, the Minerals Management Service estimated a mean of 85.9 billion barrels of undiscovered recoverable oil and a mean of 419.9 trillion cubic feet of undiscovered recoverable natural gas in the Federal Outer Continental Shelf of the United States."); *Outer Continental Shelf (OCS) Statistics* , IER (June 23, 2008) http://instituteforenergyresearch.org/analysis/outer-continental-shelf-ocs-statistics/ [https://perma.cc/ZP2H-RF8A] (note that the OCS is 2.75 million square

With this broader scope in mind, one will recognize that avoiding the "making", "selling", "using", and "importing" of components into US territories, or in a manner subject to the OCSLA, is generally impractical for offshore operators. This is especially true when confronted with an experienced patent drafter able to structure claims so as to read upon a component as found in US territories, prior to or after its use offshore. In some instances, claims can *even* be drafted to cover innovative operations *outside* US jurisdiction.[32] As discussed in the footnote, this is particularly true for offshore robotics and remotely operated systems – two technical areas believed to one day provide much of the offshore cost savings.[33]

Table 1 breaks 35 U.S.C. § 271 down into greater detail, explaining in the footnotes how a drafter would draft a claim to take advantage of 271's broader scope.

Act	**Location**	**Restrictions / Consequences**
Made	Outside US Territory	Article must not be imported into the US[34], nor a "substantial portion" of the components exported from the US[35]
	Inside US Territory	Infringement
Use	Outside US Territory	Use must not be directed from within the US (e.g., shore-based teleoperation of an ROV must

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miles (or 1.76 billion acres about 75% the size of the United States itself)).

[32] *See, e.g.*, NTP, Inc. v. Research In Motion, Ltd., 418 F.3d 1282 (Fed. Cir. 2005). One need only put the "system as a whole into service" from within the United States. For example, rather than claiming, say, a testing sequence for improving HDVC *in situ*, the drafter need simply claim the hardware used to perform the testing anticipating an analysis where the hardware is put "into service" via an onshore operator. Even if the tester attempts to delay assembly of the hardware until reaching extra-territorial waters, they may still be liable if they export hardware primary components from shore.; *See Promega*, 773 F.3d 1338.

[33] Michael McDonald, *The Future of Offshore Drilling Could Be Unmanned*, OILPRICE.COM (Apr. 7, 2015), http://oilprice.com/Energy/Energy-General/The-Future-Of-Offshore-Drilling-Could-Be-Unmanned.html. [https://perma.cc/7AHH-TYTB].

[34] *Enercon GmbH v. International Trade Com'n*, 151 F.3d 1376 (Fed. Cir. 1998). Patentee alleged defendant was planning to import infringing variable wind turbines. As evidenced by this particular case, with foreign entities taking the lead in the adoption of renewables, this may become a recurring fact pattern.

[35] *See, e.g., Promega* and pending Supreme Court case, *supra* note 27.

		not put an infringing component on the ROV into use)[36]. If in the Continental Shelf, must not be a device "permanently or temporarily attached to the seabed" or meant to "transport resources obtained from the seabed".[37]
	Inside US Territory	Infringement
Sold	Outside US Territory	Sale must not be made from the US[38]

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[36] *See, e.g.*, *NTP*, 418 F.3d. 1282. Note the careful distinction between method and apparatus claims. To infringe a method, ALL steps must occur within the US.;

> The question before us is whether the using, offering to sell, or selling of a patented invention is an infringement under section 271(a) if a component or step of the patented invention is located or performed abroad. . . . '[i]t is well established that a patent for a method or process is not infringed unless all steps or stages of the claimed process are utilized.'"

Id. at 1315, 1318 (quoting Roberts Dairy Co. v. U.S., 530 F.2d 1342, 1354 (1976)). Thus, when presented with a situation where some steps of a patented process occurred outside the United States, the Federal Circuit held "that a process cannot be used 'within' the United States as required by section 271(a) unless each of the steps is performed within this country." *Id*. at 1318. In contrast, to infringe an apparatus, the infringer need merely put the system as a whole into service. *Id.* at 1317 ("The use of a claimed system under section 271(a) is the place at which the system as a whole is put into service, i.e**., the place where control of the system is exercised and beneficial use of the system obtained**. Based on this interpretation of section 271(a), it was proper for the jury to have found that use of NTP's asserted system claims occurred within the United States. RIM's customers located within the United States controlled the transmission of the originated information and also benefited from such an exchange of information. **Thus, the location of the Relay in Canada did not, as a matter of law, preclude infringement of the asserted system claims in this case.**") (citations omitted) (emphasis added). Accordingly, just as "RIM's customers located within the United States controlled the transmission of the originated information and also benefited from such an exchange of information", a teleoperator receiving feedback and directing operations is likely "putting the innovation in service" in a similar fashion. *Id.* Drafters would accordingly direct their claims to shore-side operations whenever possible.

[37] *See* WesternGeco L.L.C. v. Ion Geophysical Corp., 776 F.Supp.2d 342, 371 (S.D. Tex. 2011) (discussing OCSLA-based jurisdiction).

[38] A "sale" for purposes of 35 U.S.C. § 271, occurs where the sale is made. *See, e.g.*, North American Philips Corp. v. American Vending Sales, Inc., 35 F.3d 1576, 1579 (Fed. Cir. 1994) ("Thus, the statute on its face clearly suggests the conception that the "tort" of patent infringement occurs where the offending act is committed and not where the injury is felt."). *Cf.* Halo Electronics, Inc. v. Pulse Electronics, Inc., 769 F.3d 1371, 1379 (Fed, Cir. 2014) ("[W]e conclude that, when substantial activities of a sales transaction, including the final formation of a contract for sale encompassing all essential terms as well as the delivery and performance under that sales contract, **occur entirely outside the United States**, pric-

	Inside US Territory	Infringement

TABLE 1: Offshore Infringement Complications

Operating outside US territories for *all four* segments of the industry, simply to avoid infringing these patent claims, seems to not be generally practical.[39] Consider, e.g., an offshore energy installation in the EEZ of the Gulf of Mexico to service energy needs in, say, Texas. Despite being outside US territorial waters, avoiding any infringement risks for such an installation would be quite costly. Staging and storage would need to occur outside the United States (Mexico or Cuba are likely candidates, incurring additional transport costs). The manufactured materials would need to be imported to those locations (South Korea or Northern Europe are likely manufacturing alternatives to the United States, but would again incur additional transport costs). Installation must then carefully avoid entering any US territorial waters, lest any articles onboard run afoul of 271's "import" scope. In some instances, the deck of US ship may itself be "US territory" able to sustain an infringement action.[40] Accordingly, US vessels must not be used or flags of convenience used that may precipitate deck-side infringement. Finally, any subsequent operations, repairs, and replacement must avoid contact with US territory. Compatibility and testing must not occur on US shores. Neither may replacements and "components" be stored on US shores.

Yet, for all this effort, it may be impossible to avoid infringement in some instances. Safety regulations may require operation in territorial waters.[41] It will be necessary to interface with various subsea components (pipelines, HDVC connectors, etc.) inside territorial waters. Indeed, as discussed in greater detail below, interactions between onshore and offshore facilities are likely to increase as renewables and hydrocarbon platforms share service providers to

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ing and contracting negotiations in the United States alone do not constitute or transform those extraterritorial activities into a sale within the United States for purposes of § 271(a).") (emphasis added).

[39] Again, cost avoidance is an increasingly critical requirement for offshore development.

[40] Gardiner v. Howe, 9 F.Cas. 1157, 1158 (C.C.D. Mass. 1865); *see also* United States v. Flores, 289 U.S. 137 (1933) for a more colorful criminal example. In Marconi Wireless Tel. Co. v. United States, 99 Ct. Cl. 1 (1942), *aff'd in part and rev'd in part on other grounds*, 320 U.S. 1 (1943), a district court relied on Gardiner and Brown to hold that the manufacture and use of infringing receivers in the United States Naval Radio Station at the American Legion in Peking, China, occurred within the "United States, and the Territories thereof."; *but see* Ocean Science Engineering, Inc. v. United States, 595 F.2d 572 (1979).

[41] E.g., Approval of an Oil-Spill Response Plan under 35 CFR § 254 may depend on the installation satisfying certain proximity and interfacing requirements with on-shore systems.

economize their interdependence. Thus, it may be impossible to avoid infringing some articles. When one seeks to avoid infringing a single patent, these alternatives may be suitable, but when confronting even a moderately-sized thicket, extra-territorial remediation would quickly become unmanageable.[42]

As discussed in greater detail in the following section, offshore energy must reduce costs. Performing elaborate gymnastics to avoid entering US territory is explicitly at odds with this requirement (though it may provide certain negotiating leverage, as discussed in the final section).[43] The industry would be better served by devoting its efforts to address the real economic and technical challenges confronting it, rather than devoting resources to overcoming this patent blockage.

C. Offshore Energy Challenges and Technical Innovation

While a patent holdup does not appear to be in effect as of this writing, this Section explains the existing forces that could very likely precipitate such a holdup as the offshore ecosystem evolves. First, both offshore hydrocarbon and offshore renewable technologies *must* innovate and implement new technologies to address various economic realities, at a time when offshore activities are likely to be delegated among smaller actors to manage costs. Second, innovation in offshore hydrocarbon acquisition is *interdependent* with innovation in offshore renewables as the two markets are not substitutes, but complements. Absent a coordinated response to these pressures by market participants, rent seekers and technical complexity may precipitate an industry-wide lock down.

1. Economic Pressures to Innovate

Three pressures have primarily threatened the future of the offshore hydrocarbon industry. First, regulatory oversight has increased following the 2010 Deepwater Horizon incident.[44] Second, while there is no shortage of hydrocar-

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[42] As discussed below, the railroads quickly found this patent-by-patent remediation intractable. *Infra,* Part II.

[43] *See infra*, Part III.B. regarding the creation of a Baseline Specification where extraterritorial remediation may be used in the event of negotiation failures.

[44] *See, e.g.*, U.S. ENERGY INFORMATION ADMIN, U.S. GULF OF MEXICO SHARE OF GLOBAL ACTIVE OFFSHORE RIGS DECLINES SINCE 2000, (Sep. 22, 2015) http://www.eia.gov/todayinenergy/detail.php?id=23032 [https://perma.cc/K3G2-GPEX] ("The number of active offshore rigs in the U.S. GOM declined from 122 in January 2000 to 41 in January 2010, before falling to 19 in June 2010 following the Deepwater Horizon offshore explosion and blowout. The U.S. GOM active offshore rig count recovered to 57 by December 2014, and currently the number is 33.") *See also*, *Reforms since the Deepwater Horizon Tragedy*, BUREAU OCEANIC ENERGY MANAGEMENT

bons in the world, most of the "easily accessible" offshore wells are being depleted.[45] Third, and perhaps most importantly, the price of oil has dropped dramatically. In November 2013, a barrel of oil sold for ~$100. In October 2016, however, the same barrel sold for ~$45.[46] For reference, to be profitable, most existing offshore facilities need oil to be between $60-80 a barrel.[47] The reasons for the collapse in the oil price are varied[48], but whatever the cause, increasing consensus appears to be that depressed prices will remain the norm.[49] Particularly, the offshore oil industry must innovate to operate efficiently at the new, lower price point and to more profitably survive periods of

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https://www.boem.gov/Reforms-since-the-Deepwater-Horizon-Tragedy/ (retrieved Apr. 10, 2017) [https://perma.cc/P9MJ-QPCX]. Again, such safety-based oversight is not a historical novelty. The railroads were plagued poor braking systems. *See, e.g.*, USSELMAN, *supra* note 9 at 133. Like the railroads, offshore energy can learn by catering to public perceptions, regardless of technical innovation. Regarding the introduction of safety brakes, R. Harris wrote: "I have no doubt that it will be made a subject of reference in advertisements . . . and that whether the traveling public would really be more safe or not, they would *think* so." *Id.* at 133.

[45] *See, e.g.*, Richard G. Miller & Steven R. Sorrell, *The Future of Oil Supply*, 372 PHIL. TRANSACTIONS OF THE ROYAL SOC'Y (THEME ISSUE) 11-13 (2014); *see also* George Given & Jeff Suchadoll, *The Balancing Act A Look at Oil Market Fundamentals Over the Next Five Years*, DELOITTE, https://www2.deloitte.com/us/en/pages/energy-and-resources/articles/future-of-oil-markets-next-five-years-marketpoint.html [https://perma.cc/8765-NTJX]. This trend is expected to continue and applying existing technologies to these more challenging plays raises the offshore developer's costs.

[46] *See Crude Oil Prices - 70 Year Historical Chart*, MACROTRENDS.NET http://www.macrotrends.net/1369/crude-oil-price-history-chart for a historical summary [https://perma.cc/2DVA-69RB], including recent trends.

[47] Sue Goodridge, *Offshore Drillers Suffer as Oil Prices Remain Below Break-Even*, MARKET REALIST (Oct. 6, 2015, 11:31 AM) http://marketrealist.com/2015/10/offshore-drillers-suffer-oil-prices-remain-break-even/ [https://perma.cc/PR3X-U4HT].

[48] *See, e.g.*, Given, *supra* note 45.

[49] Spencer Dale, *New Economics of Oil*, 1 OIL & GAS, NAT. RESOURCES & ENERGY J. 365, 366 (2016) ("Two changes in particular have had a profound impact on the economics of the oil market. The most significant change stems from the US shale revolution: the rapid growth of on-shore oil production in the US, typically using hydraulic fracturing (or fracking) techniques to extract oil from shale and other types of so-called tight rocks. The second major change is occurring more slowly and arises from the increasing concerns about carbon emissions and climate change."). Oil prices have always been volatile, but volatility around this lower pricing point will have dramatic consequences for the offshore industry. The offshore oil industry will need to adapt and reduce its costs. *See generally*, Mark J. Kaiser & Brian F. Snyder, *Reviewing rig construction cost factors*, OFFSHORE DIGITAL MAG., July 1, 2012, http://www.offshore-mag.com/articles/print/volume-72/issue-7/rig-report/reviewing-rig-construction-cost-factors.html ("The time to construct a rig depends on a number of factors but is typically 18 to 36 months") [https://perma.cc/U2JH-R5TJ].

at-cost production.[50]

These pressures may be summarized as follows: as the costs for regulatory compliance and extraction have *risen*, the market price available to pay for these higher costs, while volatile, has generally *fallen*. As one would expect, this has resulted in contraction in the offshore oil industry.[51] While reluctant to pull out in the event prices rise, offshore operators are already "cold-stacking" their rigs, selling equipment, and laying off employees.[52] Reducing infrastructure in this manner may be necessary to cut short-term costs, but may prolong the next rise in the oil price cycle.[53] Indeed, as stockpiles fall and demand rises

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[50] Matthew DiLallo, *Why Oil Prices Pushed Oceaneering International's Stock Down 13.5% in December*, The Motley Fool (Jan. 5, 2016, 11:06 AM), http://www.fool.com/investing/general/2016/01/05/why-oil-prices-pushed-oceaneering-internationals-s.aspx [https://perma.cc/3HNP-3K6L] ("With oil prices continuing to grow weaker, oil companies are being forced to think long and hard before making a final investment decision on new oil projects. Not only that, but with oil as low as it is, many companies are cutting out any costs that aren't 100% necessary.").

[51] *See, e.g.*, Paul Davidson, *Cheap oil prices chop jobs by thousands*, USA Today (Mar. 31, 2015, 6:36 PM), http://www.usatoday.com/story/money/business/2015/03/31/oil-job-cuts/70683670/ [perma.cc/8XPP-RMZW] ("About 91,000 energy-related job cuts have been made public since early December . . . Oilfield services companies, including Schlumberger and Baker Hughes, have announced about 69,000 layoffs the past four months, Continental's count shows . . . Oil and natural gas producers, including Chevron and BP, have said they're chopping 10,000 jobs. And manufacturers, such as those that make steel for oil pipes and storage tanks, plan about 11,700 reductions.").

[52] *See, e.g.*, David Wethe, *Mothballing the World's Fanciest Oil Rigs Is a Massive Gamblehttps*, Bloomberg, www.bloomberg.com/news/articles/2016-09-19/at-500-million-a-pop-it-s-an-oil-gamble-that-has-no-precedent (Sept. 19, 2016) [https://perma.cc/4YHB-YWNG]. Indeed, in many jurisdictions, there occur periods of varying duration when it's not even profitable to extract oil. *See, e.g.*, Alanna Petroff, *What it costs to produce a barrel of oil*, CNN (Nov. 24, 2015 12:58 PM), http://money.cnn.com/2015/11/24/news/oil-prices-production-costs/ [https://perma.cc/S8KE-JULH] ("In the United Kingdom, it costs $52.50 to produce a barrel of oil—which is trading right now around $42. Oil production in Brazil costs nearly $49 per barrel. Production costs around $41 a barrel in Canada. In the United States, production costs are $36 a barrel—still below the trading price.").

[53] At least one analyst predicts $120 a barrel by 2018. Dan Dicker, *$120 Oil As Soon As 2018?*, OILPRICE.com (Apr. 04, 2016, 3:18 PM), http://oilprice.com/Energy/Oil-Prices/120-Oil-As-Soon-As-2018.html, [https://perma.cc/4NBB-MQME] ("But most analysts agree that the sharp drop in Capex budgets, not just among shale producers, will have its effect on sharply lowering production this year and putting growth in reverse, efficiencies and well cost reductions notwithstanding. What's critical to note is how the media, and surprisingly most analysts, see global oil merely through the prism of U.S. independent shale players. To me, this is the critical grave mistake they make. Recent lease outcomes in the Gulf of Mexico, problems in Brazil and the likely end of spending for all new Russian oil projects are just a few of the other gargantuan gaps in global production we're likely to see

in the future, the decommissioned infrastructure may make it difficult to respond to the higher demand. This prolonged recovery may have dramatic consequences for an already sluggish world economy.[54]

Thus, the industry is attempting to respond to these pressures over the longer term by actively seeking new technologies to accommodate regulatory requirements while simultaneously reducing costs.[55] In addition, the industry has sought to identify alternative offshore markets to complement their balance sheets.[56] One such market is the offshore renewables market. Interestingly, the drop in oil prices generally does *not* result in decreased demand for renewables.[57] Indeed, while existing demand for renewables is brittle and low, that demand is on the rise and investment has risen considerably as evidenced by Figure 6.[58]

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after 2016.").

[54] Scott Nyquist, *Lower oil prices but more renewables: What's going on*?, MCKINSEY & CO. (June 2015), http://www.mckinsey.com/industries/oil-and-gas/our-insights/lower-oil-prices-but-more-renewables-whats-going-on [https://perma.cc/LY66-6YVD] ("The United States is on course to install 12 gigawatts of renewable capacity this year, more than all conventional sources combined.2 Wind capacity grew by 8.1 percent in 2014, and based on its analysis of projects in the works, the US Energy Information Administration (EIA) estimates capacity will grow another 13.1 percent in 2015 and 10.9 percent in 2016. Solar is growing even faster, though from a smaller base. Between now and 2022, the EIA predicts that renewables will account for the majority of new power; by 2040, its US market share could be 18 percent, up from 13 percent in 2013.").

[55] Gautum Chaudhury, *Innovation Can Sustain Deepwater Market at Current Prices*, OFFSHORE DIGITAL MAG. (June 8, 2016), http://www.offshore-mag.com/articles/print/volume-76/issue-6/deepwater-market-analysis/innovation-can-sustain-deepwater-market-at-current-prices.html [https://perma.cc/NG8V-5QMJ], ("Visionary leadership must challenge the business as usual and promote a culture of innovation to technology, safety, and operations to reduce cost, increase recovery, and improve safety.").

[56] *See* DT _Amanda, *Bibby Offshore moves into offshore wind cable installation*, ROVWORLD SUBSEA INFO. (Sept. 6, 2016 9:18AM) http://www.rovworld.com/article6990.html [https://perma.cc/HS86-59DL].

[57] *See* Nyquist, *supra* note 55. Indeed with a sluggish outlook for the world economy, it is imperative that low-cost energy extraction continue to be pursued. *See* editorial, Teresa Tritch, *The Economy Has Slowed Down*, N.Y. TIMES, TAKING NOTE (Aug. 1, 2016), http://takingnote.blogs.nytimes.com/2016/08/01/the-economy-has-slowed-down/ [https://perma.cc/M3S8-WZEJ].

[58] Chris Mooney, *Turns out wind and solar have a secret friend: Natural gas*, WASHINGTON POST (August 11, 2016), https://www.washingtonpost.com/news/energy-environment/wp/2016/08/11/turns-out-wind-and-solar-have-a-secret-friend-natural-gas/ [https://perma.cc/YY6A-NZCM] ("Two of the U.S.'s largest states by population, California and New York, have both mandated that power companies get fully 50 percent of their electricity from renewable sources by the year 2030.").

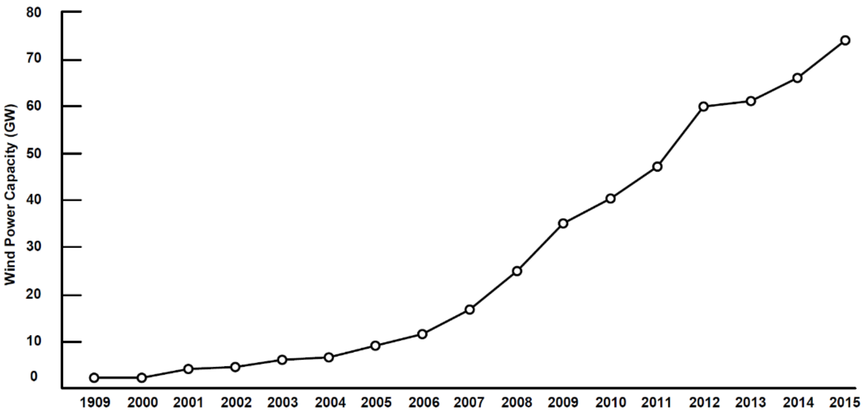

FIGURE 6: Historical Worldwide Increases in Wind Power Capacity[59]

Unfortunately, like offshore hydrocarbon acquisition, offshore renewables are also expected to rely on technology innovation to reduce their costs.[60] Like offshore hydrocarbon acquisition, these innovations will likely follow from incremental improvements in the various subsystems throughout each of the industry stages.[61] Such localized, incremental improvements will be diversified

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[59] Adapted from information in *Wind Energy Facts at a Glance*, AMERICAN WIND ENERGY ASS'N, http://www.awea.org/Resources/Content.aspx?ItemNumber=5059 (last visited Jan. 7, 2017) [http://perma.cc/ED26-VCGC].

[60] *See, e.g.*, INTERNATIONAL RENEWABLE ENERGY AGENCY, THE POWER TO CHANGE: SOLAR AND WIND COST REDUCTION POTENTIAL TO 2025 (2016), http://www.irena.org/DocumentDownloads/Publications/IRENA_Power_to_Change_2016.pdf (retrieved Apr. 10, 2017) ("[I]f we are to minimize the costs of the transition to a truly sustainable energy system, further cost reductions are needed . . . although solar and wind power technologies are commercially mature, they are far from mature from a cost perspective . . . By 2025 the total installed costs of a reference offshore wind farm could be reduced by around 15% compared to today given technological innovations") [https://perma.cc/WH7B-53B2]. Like offshore wind, railroad technology was generally imported from abroad. USSELMAN, *supra* note 9, at 61 ("[the founders of the early railroad lines] took a new, European invention – the combination of steam locomotives, fixed rails, and a train of carriages or wagons – and scrambled to adapt it to different sets of conditions . . . [t]o European eyes, the American lines were primitive affairs . . . ."). Many US organizations are likely adopting a "wait and see" approach, to see how much their European and Asian counterparts can reduce the costs. Unfortunately, volatile and reduced oil prices appear to be reducing the available delay.

[61] NAVIGANT, OFFSHORE WIND MARKET AND ECONOMIC ANALYSIS 17 (2013) https://www1.eere.energy.gov/wind/pdfs/offshore_wind_market_and_economic_analysis.pd

among a greater number of actors as the industry continues to downsize.[62] Unlike offshore hydrocarbon acquisition, however, competitive adoption over traditional energy sources primarily motivates renewables cost reduction, rather than the plurality of factors outlined above. That said, those same factors *do* determine the price point for traditional energy sources, and so indirectly determine renewable cost-effectiveness. Indeed, as discussed in the next section, innovation and development in offshore hydrocarbon acquisition is very much intertwined with innovation and development in offshore renewables.

2. Offshore Market Interdependence

Wind, solar, and other renewables (hydropower being a notable exception) generally do not provide power continuously. The wind ceases to blow, the sun sets, ocean currents ebb and flow, etc. Consequently, peak demand and peak power collection rarely coincide.[63] Storage technology has not yet addressed,

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f [https://perma.cc/Q56M-AK44]. With blades, advanced composites including carbon fiber, new resins, epoxies and other materials are likely to be increasingly deployed. With foundations, it is likely that the combination of diverse seabed conditions, deeper water, and larger turbines will push the industry away from mono-pile foundations to alternatives such as jackets, tripods, gravity base structures, floating structures, and suction caissons. With drivetrains, high-energy density permanent magnets sourced from rare earth materials offer the potential to realize direct drive technologies, although new direct drive platforms lack an extensive performance record. It is not yet clear that direct drive generators offer superior performance and reliability under the actual working conditions experienced by offshore turbines. As a final example, lower cost power conversion is expected from deployment of higher voltage power electronics.

For comparison, *see* USSELMAN, *supra* note 9, at 2 ("Even after the network took shape, moreover, railroads remained in constant flux. Each component in the railroad ensemble – locomotives, cars, rails, and elements of the physical infrastructure such as bridges and stations – underwent virtually perpetual refinement".). This innovation can itself beget innovation as it generates a need to reconcile new improvements with old methodologies (e.g., accommodating heavier cars on existing rails). That reconciliation may then itself impost a requirement for novelty in another area (e.g., creating modified signaling to anticipate adjusted rails), and on and on. Shifts in demand, both increasing and decreasing, can likewise impose new constraints. *Id.* at 3 ("At no point in history, then, did America railroading reach some steady state in which pressures to innovate abated and technology stagnated.").

[62] Christopher Helman, *Will Oxy's Divorce Spur the Break Up of Big Oil?*, FORBES (Feb. 19, 2014, 11:28 AM) http://www.forbes.com/sites/christopherhelman/2014/02/19/will-oxys-divorce-encourage-the-break-up-of-big-oil/#6457ad297504 [https://perma.cc/3Y6J-N4H9].

[63] Elena Verdolini, Francesco Vona & David Popp, *Bridging the Gap: Do Fast Reacting Fossil Technologies Facilitate Renewable Energy Diffusion?*, 51.2016 NOTA DI LAVARO 1, 2 (2016). Thus, integration will likely involve a primary dependence on Natural Gas with hydrocarbon usage reduced in accordance with renewable availability.

and is not expected to address in the near future, this cyclic behavior.[64] Thus, even a "perfectly" functioning renewables installation will depend on hydrocarbon reserves for inactive periods.[65] Accordingly, renewables tend to serve as complements to natural gas-based energy sources, rather than as entirely independent markets.

This interdependence is both a potential opportunity and a potential curse for offshore energy service providers.[66] On the one hand, by anticipating the effect of one energy source upon the market for the other, costs may be reduced globally. For example, service providers can consolidate operations, rather than maintaining and improving two independent industries. Technical improvements and standards in one industry can be reused in the other. Improvements in foundations, installation technologies, ROV operations, standardization, service vessels, satellite technology, etc. can be coordinated between the industries.[67] Put a different way, offshore energy providers can participate in "both sides" of the energy equation – installing and maintaining offshore renewables as natural gas prices rise and maintaining offshore renew-

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[64] *Id.* at 20 ("It is indeed well known that the speed of technical change in storage technologies will be as important as the direct speed of technical change in RE technologies to make RE autonomous and thus fully substitutable to fossil fuel technologies." *Id.* at 23 ("This highlights the fact that to date investors in FRF plants seem to have paid little attention both to the installed capacity in RE and to environmental policies. It also provides some evidence that there is a sort of 'asymmetric' complementarity between RE and FRF investment, where the latter are key support technologies for the former, but not *viceversa* [sic]."). *Id.* at 26 ("We show that absent economically viable storage options, countries where FRF capacity was available were more likely, *ceteris paribus*, to invest in renewal energy generation.").

[65] Despite the ongoing decrease on coal dependence, natural gas remains a favored "fast-reacting" fossil fuel to complement renewables.

[66] USSELMAN, *supra* note 9, at 95:

> With enormous plants and high fixed costs, large railroads in particular focused on building and sustaining a heavy volume of traffic. Because they consumed large quantities of raw materials and manufactured bulky finished products, rail mills presented a particularly attractive means of building up trade. The switch from iron to steel gave railroads the opportunity to relocate rail mills to their benefit. Once they became established, the flow of traffic to and from the mills discouraged railroads from acting as simple consumers and contracting freely with all producers. Railroads wanted to build their own traffic as much as possible and avoid bolstering the business of a competitor.

[67] Verdolini, *supra* note 63, at 26 ("Our paper calls attention to the fact that renewables and fast-reacting fossil technologies appear as highly complementary and that *they should be jointly installed* to meet the goals of cutting emissions and ensuring a stable supply.") (emphasis added). This complementarity is an important consideration in the creation of the Baseline Specification, discussed *infra*.

ables for natural gas complementarity when natural gas prices fall.[68] Thus, offshore renewables may potentially provide a localized complement to the world-wide price setting of natural gas.

On the other hand, however, failure to anticipate such interdependence can deprive service providers of opportunities to service both, or either, market successfully. Patent blocking in offshore hydrocarbon production may result in decreased adoption of renewables, as supplemental hydrocarbon reserves rise in price. Conversely, patent blocked renewables may deny offshore service providers the opportunity to service both markets. That inability may force operators to operate below a break-even price point.[69] Certainly, designing systems to anticipate and transition between renewables and hydrocarbons at the behest of a temperamental electrical grid will itself require substantial technical effort.[70] Such efforts will almost certainly occur onshore, well within the jurisdiction of US courts. Rather than encouraging mutual growth, this interplay can result in hydrocarbon development limiting renewable development and vice versa. As discussed below, implementing defensive patent arrangements and industry-wide standards can help avoid this outcome.[71]

The renewables-hydrocarbon interdependence also impacts regulation efforts.[72] For example, both industries are heavily subsidized by the government,

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[68] *Id.* at 26.

[69] Interplay between the renewables and hydrocarbon markets bears some similarity to interplay between steel and the railroad lines. By investing in steel for their own use the railroads were *also* making an investment in secondary markets for steel. Similarly, hydrocarbon markets feed into renewables markets, and offshore installations into onshore installations. *See, e.g.,* USSELMAN, *supra* note 9, at 81-82 (discussing the Bessemer process patent, Bessemer Association, and the interplay between railroads and "healthy enterprises" along their routes.).

[70] *See, e.g.,* Integrating Renewable Energy into the Electricity Grid http://info.aee.net/hubfs/EPA/AEEI-Renewables-Grid-Integration-Case-Studies.pdf?t=1440089933677 (retrieved Apr. 10, 2017) ("[T]he decline in solar production at the end of the day can lead to significant ramping needs for grid operators. Dispatchable non-solar resources (existing fossil and hydro generation but also potentially demand resources) must be rapidly deployed to make up for the decline in solar PV generation at the same time that residential electricity demand is rising at the end of the day") [https://perma.cc/LFJ5-FK9B].

[71] The ever-present need for standardization is well established in historical precedent. *Id.* at 216 ("Because both railroads and steel makers *labored under conditions of ignorance*, in which *they lacked fundamental understanding about the factors influencing rail performance, neither could proceed in complete isolation from the other*.") (emphasis added).

[72] In an almost eerie parallel, modern populist movements also find parallels in the railroad and as well as subsidies coupled with mixed motivations. Whigs got a taste of this project-oriented populism through their brief experience with the telegraph. In 1842, after years of debate, Congress agreed to contribute a modest sum of $44,000 . . . . This project, like

but such subsidization is inefficient when it ignores the two industries' interdependence.[73] Increasing renewables subsidization while simultaneously imposing restrictions on local oil production, though superficially an "environmentally friendly" pairing, is ultimately illogical and counterproductive.[74] Responding reactively in an ad hoc manner to such interdependent pressures, as occurred in the American railroad, discussed below, is inappropriate for offshore energy.[75]

D. Conclusion

In summary, these observations result in a common conclusion: *all* offshore technologies for energy acquisition, whether for hydrocarbons or for renewables, will likely soon *be seeking to reduce their costs through innovation and collective coordination*.[76] This coordination must provide a forum for con-

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most subsequent telegraph lines, would primarily serve the interests of the financial intermediaries who desired to receive information about prices as quickly as possible. Several members of Congress stood to benefit directly from the service."

Id. at 30.

[73] Again, parallels to government involvement in the railroad are directly on point. See, for example, USSELMAN, *supra* note 8, at 384 ("Government thus indirectly became party to innumerable choices regarding rail technology, including such key decisions as when to convert to diesel locomotives and how automate the monitoring of car movements. Perhaps not surprisingly, railroading became a prime example for those who believed that government bureaucratic impeded creativity and stifled innovation."). *Id.* at 385 ("Efforts to regulate the railroad technology were as old as the first experimental lines. . . . The regulatory activities of the twentieth century, then, were no aberration . . . .").

[74] Verdolini, *supra* note 63, *passim*.

[75] For discussions regarding the railroad's reactive approach to technology inefficiencies, *see* USSELMAN, *supra* note 8, at 128, 182, 191. Regarding inefficiencies in maintenance and standardization between different firms, *see id.* at 192. The compensation schemes for repairing other firm's cars are not unlike aspects of interfirm cooperation in the Baseline Specification for offshore energy described below. *See infra* Section III B.

[76] The need to decrease costs is not unique to offshore oil, but an increasing specter in onshore oil, *see, e.g.*, Gail Tverberg, *The Coming Oil Price Crash*, OILPRICE.COM (Oct. 12, 2016, 3:04 PM CDT), http://oilprice.com/Energy/Energy-General/The-Coming-Oil-Price-Crash.html [https://perma.cc/E3E8-KZW5]. Again, not just offshore renewables but ALL energy must become cheaper, *see id.* ("This energy must be inexpensive . . . ."). While the author isn't entirely sympathetic to all Ms. Tverberg's Malthusian predictions, she is correct that energy extraction must become more efficient to address lower prices, *see id.* ("I am doubtful that the price of oil can rise very high, for very long. Our oil price problem is part of much larger problem – a slowing economy with low prices for a large number of commodities, including oil."). Even when cost reduction is not a matter of profitability for offshore providers, it can be an important vehicle for leverage during market negotiations. *Oil Prices in Crisis, Considerations and Implications for the Oil and Gas Industry*,

trolled technology adoption addressing economic, technical, and patent blocking considerations. As discussed in the next section, a patent platform can help resolve many of these issues.

II. PATENT PLATFORM OVERVIEW

"History doesn't repeat itself, but it does rhyme."[77]
"Patents and passes will be the death of me."[78]

As discussed in the previous section, future offshore energy innovation and implementation must remain cheap and efficient. The development of the American railroad was neither cheap nor efficient.[79] This should be somewhat concerning to members of the offshore energy innovation community as the two industries share many similarities. They are both 1) utility systems 2) regulated by state and federal governments, as well as 3) subsidized to a certain extent by state and federal governments[80], for 4) geographically sensitive applications, which are 5) affected by international developments[81] and 6) demand from interdependent and external markets,[82] whose 7) ongoing operations and

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DELOITTE, https://www2.deloitte.com/content/dam/Deloitte/us/Documents/energy-resources/us-oil-prices-in-crisis-considerations-and-implications-for-the-oil-and-gas-industry-02042015.pdf [https://perma.cc/L7QH-NDEK] ("Rather than acting to defend prices, the Gulf producers within the organization, led by Saudi Arabia, are working to defend their global market share. In doing so, they are gambling that as the lower cost producers, OPEC members will ultimately prevail over more costly unconventional operators.").

[77] Often attributed to Mark Twain (while the Author has no direct evidence that Samuel Clements actually made the observation so succinctly, he certainly did made make quite similar observations).

[78] USSELMAN, *supra* note 9, at 117 (quoting Robert Harris, Chief Operating Officer of the Chicago, Burlington, and Quincy railroad); *see also id.* at 381 ("The issues Americans confronted in attempting to regulate railroad innovation have arisen time and again as new technologies emerged and evolve din the American context. This histories of telephony, electric power, highways, and networked computing, to cite some obvious examples [.]").

[79] For example, the telegraph had huge implications for communication, line signaling, breaking, and collision avoidance, yet the "railroads did not utilize the innovation in their own operations for at least another seven years" and employees were generally left to their own devices when purchasing equipment. *Id.* at 128-29.

[80] Development rivalry between cities to "lure capital and human resources away from other locales", may be repeated in the energy sector, as various communities vie for energy resources to feed and attract local businesses. *Id*. at 13.

[81] Compare, e.g., the impact of European demand on the grain market (*Usselman, supra* note 9, at 53-54) with the export of oil from US waters to foreign markets.

[82] For example, compare steel transport / rails interplay and oil / renewables interplay. Steel was both transported by the railroads to various projects and used by the railroads

competitive environment demand ongoing innovative improvements[83], which 8) are susceptible to a certain amount of patent blocking[84], and 9) involve feedback loops within their industry segments that can precipitate cost overruns and price failures[85] Eventually, after being confronted for years with patent holdups, innovation inefficiencies, and standardization disconnects, the American railroads developed an implicit patent platform arrangement (though rarely explicitly recognized as such) to address these issues.[86] This Section explains why a proactively created platform for offshore energy may avoid the ad hoc and inefficient history of the railroad.[87]

A. Bi-Lateral Agreements Compared

To understand what a patent platform *is* it may be helpful to first appreciate what a patent platform *is not*. The simplest form of contractual agreement is a *bi-lateral agreement*. A bi-lateral agreement simply involves two parties, each in possession of assets of interest to the other, that wish to perform an exchange as evidenced in Figure 7.

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themselves in their rails. Despite steel's benefits, this interdependence made transition from iron tactically difficult. *See, e.g.,* USSELMAN, *supra* note 9, at 215; *id.* at 225-226 (discussing the negotiations with Carnegie Steel). Similarly, oil and renewables are incomplete substitutes, rendering tactical transitions between them subject to similar negotiation difficulties as discussed herein. Steel transport affected the demand for steel rails. Similarly, oil stockpiles permitting complementary reserves for renewable downtime, affect the demand for renewables.

[83] Compare the discussion herein between the need for innovation in oil and renewable acquisition technologies with the discussion in USSELMAN Chapter 7, particularly the innovation efforts of the Pennsylvania railroad. *See* USSELMAN, *supra* note 9, at Chapter 7.

[84] Compare the above discussion of offshore infringement with the double-acting brakes, Pullman cars, and other patent blocking cases discussed in USSELMAN.

[85] See again, e.g., the steel transport / rails interplay and oil / renewables interplay discussed above.

[86] USSELMAN, *supra* note 9, at 7. ("Efforts to channel technical change and reshape railroad innovation, while influenced always by various economic incentives, seldom boiled down simply to making rational choices grounded strictly in hard economic data.").

[87] For a more thorough introduction to the practical applications of Patent Platforms, *see generally* LARRY M. GOLDSTEIN & BRIAN N. KEARSEY, TECHNOLOGY PATENT LICENSING: AN INTERNATIONAL REFERENCE ON 21ST CENTURY PATENT LICENSING, PATENT POOLS AND PATENT PLATFORMS (2004).

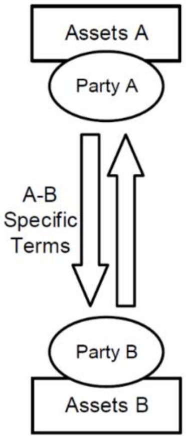

FIGURE 7: Bi-Lateral Agreement Topology

With regard to intellectual property, a bi-lateral agreement may take the form of a simple cross-licensing agreement. In the nascent railroad industry and the burgeoning renewables industry, these localized agreements tend to be the preferred method of doing business.[88] They are simple, responsive to immediate concerns, and effect a quick solution with little overhead infrastructure. Unfortunately, such agreements entered into in isolation lack any global recognition of industry-wide inefficiencies and potential failures. Eventually, if only bilateral agreements are entered into without thought to the larger industry, a patchwork of obligations results that fails to anticipate any global behavior.[89] That failure facilitates patent holdup as it allows rent-seekers to take advantage of information asymmetries between industry members.[90]

This is exactly what happened in the railroad industry.[91] After an initial period of uninhibited growth, without any overarching adoption oversight, patent

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[88] *See, e.g.*, Verdolini, *supra* note 63, at 10 ("[T]he liberalization of the electricity market had the effect, among the other things, of shifting the balance of power from centralized, large and regulated providers to smaller actors specialized in cleaner technologies.).

[89] USSELMAN, *supra* note 9, at 10 ("This cavalier approach left [the railroads] exposed to significant liabilities, as they belatedly discovered during a well-publicized series of costly lawsuits after midcentury.").

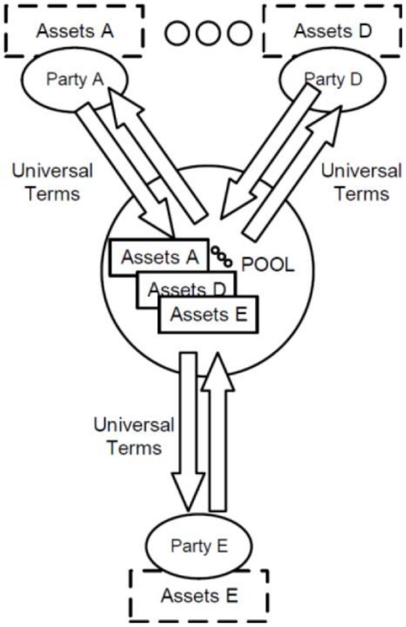
[90] Some example disasters include: the "double acting" break holdup of 1859-1862, *id.* at 108; the Swedge block cases, *id.* at 112; the axle cases, *id.* at 116; various safety patents, *id.* at 117-18; various regulation and public movements, *id.* at 120-21; the Westinghouse air brakes and vacuum brakes, *id.* at 96; signaling, *id.* at 123-24. Note that many crises, including the Pullman car and Westinghouse brakes each arose, in part, from insider trading.

[91] USSELMAN, *supra* note 9, at 143 ("[T]hough the impetus for reshaping the paths of innovation in America railroading originated from forces that transcended he immediate problems with patents, railroad mangers could not succeed in imposing new discipline over technology without resolving the nagging uncertainties regarding the patent system.").

trolls gradually took advantage of the railroads’ failure to monitor their technology introductions. Eventually, as this trolling pain,[92] as well as pain resulting from a general lack of coordination,[93] became sufficiently great, the railroads entered into trade associations, such as the Western Railroad Association (WRA) and Eastern Railroad Association (ERA), specifically designed to combat trolling, and subsequently, to coordinate technology adoption.[94] Such coordination was arguably the first step in the creation of an implicit *patent pool*, the subject of the next section.

B. Patent Pools Compared

Unlike simple bilateral agreements, a patent pool, illustrated in Figure 8 includes an overarching organization designed to receive intellectual property assets on behalf of the community.[95]



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[92] *Id. at* 117 (“ to maintain a centralized list of licensing agı

[93] The B&O’s c and helter-skelter. *Id.* at 84. In some cases ; confronting the railroad: “But in shunning a oduct made from an older technology, Garret nt industry with enormous potential.” *Id.* at 8 must make business decisions that generate hnology-based trade associations. *See, e.g.*, ociation of Transportation Officers, an in-hou

[94] “Yet the fa century is the remarkable harmony that dev lroading. Railroad testing formed a solid cor ıg societies oriented themselves, and specia ficant stature within these professional group 06 (“Ultimately, railroads would circumvent ıtions and by devising other cooperative arra ınovation.”).

[95] *See, e.g.*, G xplaining the “centralized and fixed” character of pools.).

FIGURE 8: Patent Pool Topology

Members of the pool can then avail themselves of these assets at specified rates via "Universal Terms". The Universal Terms apply to all the members, regardless of their industry status, size, operations, etc.[96] Such pools are common today for various standards setting organizations, such as MPEG, DVD, etc.[97] Members are usually motivated to participate in the pool so that they have a controlled market environment for their intellectual property.

In addition to standardizing cross-licensing,[98] the pool can also serve many other functions. For example, as discussed above with regard to the railroads, pools can motivate industry members to pool their defense funds against trolling behavior.[99] Patent trolls often request license fees that are slightly more than an individual corporation's cost to litigate.[100] By pooling defense funds and industry information, industry members can obviate this piecemeal tactic as the Eastern Railway Association and the Western Railway Association did for the railroads.[101] The pool also provides a coordinated mechanism for identifying and acquiring licenses early in patent life, when the royalties are likely cheaper, since the patent has not yet proven its value.[102]

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[96] *Id.*

[97] For a general comparison of licensing architectures, *see* GOLDSTEIN, *supra* note 87, at 68-69.

[98] For reasonable patent holders, this can be a great boon, as it ensures the existence of a market for otherwise difficult to monetize IP. This is especially important for the interdependent hydrocarbon and renewables markets, just as it was for the interdependent steel and railroad markets. USSELMAN, *supra* note 9, at 91 ("In subsequent years, negotiations for steel rails followed a similar pattern, with both the railroad and the steel makers acknowledging the mutuality of interests between them."); *id. at 185,* ("As Perkins suggested and historians have subsequently confirmed, railroads had much to gain simply by standardizing and routinizing what they already did.").

[99] "Railroads needed only to pool information and to keep a united front in their dealings with patent holders." *Id.* at 172. This prevented a "divide and conquer" strategy. *Id.* at 115.

[100] *See, e.g.*, Jared A. Smith & Nicholas R. Transier, *Trolling for an NPE Solution*, 7 HASTINGS SCI. & TECH L.J. 215, 223 (2015) ("For example, it has been reported that the median cost of defending claims of patent infringement brought by an NPE ranges between $600,000, where less than $1 million is at risk, to $4 million, where more than $25 million is at risk.13 As one commentator has noted: "even the weakest of claims" presents a "Hobson's Choice," where the defendant can choose between "settl[ing] and giv[ing] the plaintiff remedies to which it is not entitled, or spend[ing] a larger sum to prevail without any realistic prospect of fee recoupment.").

[101] Eventually collaborative response in Railway Protection Agency and Eastern Railroad Association and Western Railroad Association eventually formed. These organizations pooled costs for infringement defense. USSELMAN, *supra* note 9 at 114, 173-74.

[102] *Id.* at 106 ("[M]ost people involved with railroad technology agreed that license fees

Finally, by operating collectively, members can establish interoperating standards and a monopsony postures relative to upstream manufacturers and service providers.[103] If this resembles a cartel, it is because a pool effectively *is* a cartel, or phrased more euphemistically, a "Monopsony Coalition for Troll Exclusion." [104] Like a cartel, pools must punish members who betray these monopsony-based tactics if the pool is to remain effective. Similarly, if patent trolls realize that they can pick off pool members by offering slightly better terms, then the unity of the defense risks collapse. Accordingly, the railroad trade associations often took disciplinary measures against defectors.[105]

Despite these benefits, pools are subject to two, rather considerable, pitfalls. First, and the most obvious in the context of the railroad, is the resulting antitrust issues. Monopsony behavior, removed from the patent troll context, eventually devolves into mere anticompetitive behavior inviting intervention by the Department of Justice.[106]

Second, and more importantly in regards to offshore energy, the pool's Universal Terms are a rather blunt instrument. They apply the same benefits and obligations to *all* the members, in a "one-size-fits-all" approach that fails to consider each member's technology adoption needs. This is especially an issue in industries operating in periods of "management" rather than "development."[107] During "development" an industry wishes to innovate and adopt new technologies as quickly as possible without interference from trolls, government, or any other third party.[108] Pools, and initially bi-lateral agreements, are appropriate vehicles during this period. Once established, however, industries transition to a "management phase". During "management" the goal is <u>not</u> to

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increased during the life of the patent.").

[103] Engineers would submit devices developed in their own shops to the associations, who would arrange for patenting. The devices could then be listed for safe usage by members to deploy without fear of liability. Though not explicitly identified as such, this was simply a Baseline Specification, as discussed in Section III. B. *infra*. *Id. at* 101.

[104] "Lines would pay annual fees, assessed in proportion to earning, and in return receive full legal services, including consultation on the legal status of all inventions. In the event of a trial, patent experts employed by the association would develop common defenses for the entire group." *Id.* at 114-15; *see also id.* at 173-74, 184. This also permitted efforts to be channeled in specific directions. *Id.* at 177.

[105] "ERA amended its constitution in 1878 to provide stronger sanctions against firms that negotiated their own agreements with holders of disputed patents . . . 'To obtain the best results [the ERA cautioned] the members of the Association must act as a unit, and it is believed that his unity of action has been the true cause of our success heretofore.'" *Id.* at 173. *See also id.* at 105.

[106] Complexity and expense will itself often bar outsider innovation. *See id.* at 102.

[107] *Id.* at 184-87.

[108] *Id.*

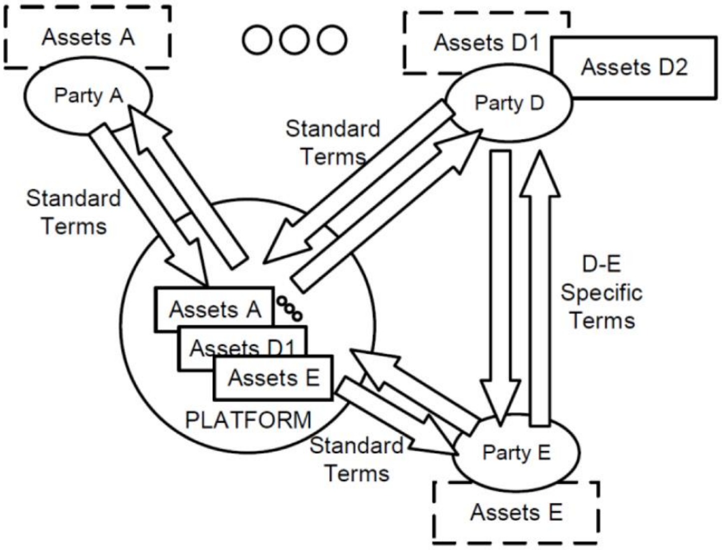
introduce the *best* technology into the industry, but to introduce the *right* technology.[109] Once established, the industry grows by improving efficiency and reducing costs, rather than by expanding its services to include every new innovation. Cost reduction is not simply a matter of introducing new technologies, but of introducing technologies in the *right manner* based upon a comprehensive view of the industry. This requires coordination and considered reflection of industry members' local needs.

In the railroads, the transition from a development to a management phase occurred over the course of several decades and was softened by a strong and ever-present demand that was willing to endure cost overruns.[110] Accordingly, the need to move past the pool structure was only gradually felt.[111] Offshore energy, in contrast, does not share this luxury. There is *already* an existing need for offshore energy to reduce costs on all fronts and to operate in the "management" regime.[112] As demonstrated by the example of the railroad industry, the "best" innovation for offshore renewables may NOT be the "right" innovation for the interdependent offshore energy ecosystem as a whole.[113]

In view of these two limitations, the following section discusses "patent platforms", the most sophisticated and final implicit structure formed in the American railroad industry post-DOJ intervention, as well as the structure most suited to the offshore energy industry.

C. Patent Platforms

As shown in Figure 9, a patent platform is similar to a patent pool.



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1: Higham. *Id.*
at 5!

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1-- Over time the railroads understood the need to "adjust the incentives to innovate" as "[p]atent rights and personal relations loomed large." USSELMAN, *supra* note 9 at 6-10.

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FIGURE 9: Patent Platform Topology

Like a pool, a platform involves a centralized organization that receives assets from each of its members. In contrast to the "Universal Terms" of the pool, however, the platform employs "Standard Terms". Unlike the "one-size fits all" character of Universal Terms, "Standard Terms" merely specify a negotiation floor for platform members.[114] That is, members are not obligated to take *exactly* the standard terms in each negotiation. Rather, platforms explicitly anticipate that members will form their own bilateral agreements to address their local needs. The Standard Terms instead provide a controlled fallback position for the negotiators when forming their bilateral agreement.[115]

Though too involved to discuss here, both pools and platforms lend themselves to a "real options" analysis.[116] By incurring the costs of membership *now*, a member reserves the *future right* to exercise membership benefits. Unlike pools, however, platforms impose fewer constraints on those future rights, making the option much more attractive to members of the community. This encourages industry members to join the platform, overcoming the network externality that so often thwarts such organized attempts at coordinated behavior.

Because they merely specify a negotiation floor, platforms are also much less likely to cause antitrust concerns.[117] Indeed, platforms continue to encourage competitive development, but within the controlled environment of the negotiation floor. By providing baseline agreement terms, platforms also facilitate standards creation.[118] The railroads realized that having technical experts create standards, rather than inventors and entrepreneurs via ad hoc efforts,[119]

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[114] Goldstein *supra* note 87 at 71 ("The platform is characterized by centralized evaluation of patents and flexibility in licensing terms, subject to the partis' agreement that the SLA (Standard License Agreement) will set the minimum licensing terms.").

[115] Negotiators will recognize this as a BATNA (Best Alternative to a Negotiated Agreement). Roger Fisher & William Ury, Getting to Yes: Negotiating Agreement Without Giving In 101-02 (Bruce Patton ed., rev. ed. 1991).

[116] A plethora of legal economics texts discuss real options. The Author has found Grundfest and Huang's paper an interesting introduction. Joseph A. Grundfest & Peter H. Huang, *The Unexpected Value of Litigation: A Real Options Perspective*, 58 Stan. L. Rev. 1267 (2006).

[117] *See generally* Goldstein, *supra* note 87, at 178-239.

[118] Usselman, *supra* note 9, at 216, 239, 240, discusses the need to standardize steel rails to facilitate vertical integration. ("[R]ailroads and steel producers had by the turn of the twentieth century constructed a new framework that buffered engineering experts from the market and left them free to address technical problems.") *Id.*

[119] *Id.* at 255:

Technical experts such as Dudley thus restructured the nature of competition, substituting better reduced costs across the industry as a whole.[120] Dependence upon technical experts better delegates the need to identify profitable technical pathways. Most importantly for offshore energy, and as discussed extensively in the next section, a negotiation floor ensures that baseline costs continue to decrease in accordance with technical standards; this was the case for railroads when they began working together.[121] Economics and technical abilities, not individual eccentricities, must govern technology adoption.[122]

In addition to obviating trolls, platforms are especially useful in industries dependent upon interoperating standards and geographically-based factors, as is the case with both offshore energy and the railroads.[123] As mentioned above, such coordination is especially important to the offshore energy installations, which require more centralized and pooled investments (albeit, generating higher and more consistent returns) as compared to their land-based peers.

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scientific analysis and systematic assessments of performance for the waste of the unregulated market . . . . Specifications created stable markets in which there existed 'steady demand' for 'staple commodities' . . . thus enabling producers to plan their business activities more thoroughly.

And:

Only the initiated understood that a Pennsylvania standard stood as the highest expression not just of an organization but of a community of shared values. When people in positions of leadership in that community spoke of discipline, as they often did, they liked to think of it as flowing from the technical requirements of the railroad system itself, not from individuals exercising authority.").

Id. at 264. *See also* similar methodology considerations found in PAUL E. CANTONWINE, THE NEVER-ENDING CHALLENGE OF ENGINEERING: ADMIRAL H. G. RICKOVER IN HIS OWN WORDS (2013).

[120] For example, offshore staging areas may provide similar knowledge bounties as did "[t]he machine shops and other maintenance facilities" for the railroads, discussed (in the context of railroads) in USSELMAN, *supra* note 9, at 63. Cost reduction also follows from vertical integration: "Burlington [railroad] managers possessed newfound appreciation for the value of linking knowledge of the manufacturing process with the performance and design of steel rails." *Id.* at 226-229, 231.

[121] "Information about railroad technology flowed among a network of interested and unequal parties whose perspectives and decisions regarding technical innovations involved a complex mix of motives." *Id.* at 107-08. Consolidation permits actors to focus innovation upon actual problems, not simply innovation for novelty's sake. *See id.* at 211–13.

[122] Steel lasted eight times longer, but cost only twice as much as iron, but workers were still reluctant to make the change. *Id.* at 78 (one can readily recognize analogies in many wind-farm technologies). Note that historically larger railroads have found it easier to innovate than smaller railroads. *See id.* at 76 n. 56.

[123] Politics, geography, and disparate financial conditions *rather than* transportation needs often dictated rates of railroad improvement. *Id.* at 83-86. Similarly, other factors than energy requirements will likely dictate offshore hydrocarbon and renewable development.

Table 2 summarizes various platform responses to frequently encountered costs.

Costs	Platform Response
General cost maintenance	Standard term floors
Third party patent trolls	Pooled defense fund; Coordinated technology adoption; Monopsony coalition for troll exclusion
Failure to standardize and consolidate innovation along efficient paths	Technical development committees and standard-drafting committees
Cross-Jurisdictional regulation	Universal Term Floors; Bilateral Agreements; Development Committees
Vertical integration tailoring	Bilateral Agreements; Universal Term Floors
Royalty stacking for Baseline activity	Baseline terms
Renewable variability and fast reacting fossil fuel complements	Common Technical Specifications and Standards

TABLE 2: Platform Cost Maintenance

As mentioned above in the context of pools' cartel-like behavior, platforms likewise facilitate a forum for industry-wide, internal governance.[124] This governance is very important to preventing the double dealing and insider behavior to which both the railroads and offshore energy are susceptible.[125] Just as the railroads suffered double dealing by insiders in the steel market, offshore energy risks double dealing by insiders in renewables/hydrocarbon markets.[126]

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[124] The railroads handled voting issues using geographical "blocks." *Id.* at 257-258. This assuaged fears that the largest block or a well-organized minority might dominate the association. *Id.*

[125] I.e., the abuse of insider knowledge.

[126] "To the extent that the profits of the steel company came solely at the expense of the Pennsylvania Railroad, the railroad (and those among its stockholders who were not privy to the inside deal) would derive no benefit other than the improved performance obtained from rails it could not have acquired from other sources. Meanwhile, such insider arrangements opened possibilities for all sorts of chicanery. Managers such as Thomson and Scott could enter contracts that effectively shifted income from the railroad to the supply enterprises in which they held substantial personal stakes." USSELMAN, *supra* note 9, at 82.

D. Conclusion

The reader should draw three conclusions from this brief historical and organizational overview. First, if offshore energy proceeds in the same reactive, unorganized manner as the railroad, market failure is likely to result. Inefficiencies in the railroad slowed expansion into the American West and slowed consolidation in the East and lower profits. In contrast, inefficiencies in offshore energy will likely raise costs above tolerable levels, precipitating market-wide failure. Second, coalition formation, *done improperly*, will *increase* costs. Third, coalition formation, *done properly*, will *decrease* costs.

III. COOPERATIVE INFRASTRUCTURE FOR OFFSHORE ENERGY TECHNOLOGY ADOPTION

A. Overview

This section briefly discusses aspects of an example platform structure that may be suitable for the offshore energy industry. Various trade associations already exist to anticipate when and how best to implement such a platform. For example, the American Counsel on Renewable Energy[127] (ACORE) and the American Petroleum Institute[128] (API) already command formidable influence in each of their respective industries. To the Author's knowledge, neither industry has yet discussed the creation of a cross-industry patent platform, let alone one specific to the needs of the offshore energy sector. Consequently, the offshore service providers may take the initiative themselves, e.g., via either

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[127] *See, e.g.*, *About ACORE*, AMERICAN COUNSEL ON RENEWABLE ENERGY, https://www.acore.org/about [https://perma.cc/EW9S-JZBA]:

> ACORE is a national non-profit organization dedicated to advancing the renewable energy sector through market development, policy changes, and financial innovation. With a savvy staff of experts, fifteen years of experience promoting renewable energy and hundreds of member companies, non-profits, and other organizations from across the spectrum of renewable energy technologies, consumers, and investors, ACORE is uniquely well-positioned to strategically promote the policies and financial structures essential to renewable energy growth. The organization's annual conferences in Washington, D.C., New York and San Francisco set the industry standard in providing important venues for key leaders to meet, discuss recent developments, and hear the latest from senior government officials and seasoned experts.

[128] *See, e.g.*, *About API*, AMERICAN PETROLEUM INST., http://www.api.org/about [https://perma.cc/UUU2-M2SE]:

> [API] is the only national trade association that represents all aspects of America's oil and natural gas industry. Our more than 625 corporate members, from the largest major oil company to the smallest of independents, come from all segments of the industry. They are producers, refiners, suppliers, marketers, pipeline operators and marine transporters, as well as service and supply companies that support all segments of the industry.

the International Marine Contractors Association[129] (IMCA) or the National Ocean Industries Association[130] (NOIA). It's unlikely that industry members would come together exclusively for the purposes of platform formation and so trade associations such as these may provide suitable forums for breaching the matter as a supplemental consideration.

Whichever organization first finds reason to consider creating a patent platform, they could easily be forgiven for finding the preceding sections overwhelming. Yet, the potential technology holdup facing the offshore energy sector can be abstracted into a simple problem statement:

> "A preferred, cost-saving technology that would ideally be available to industry members <u>is not developed and used by those members</u> either because:
> 1) Those who would buy <u>cannot afford to pay</u> the asking price; or
> 2) Those who would sell <u>cannot afford to sell</u> at the asking price."[131]

While this simplistic formulation obscures the underlying reasons for the adoption failure, it still provides an instructive basis for the platform designer's efforts. Particularly, the platform designer's primary objective is to create a technology adoption infrastructure for the industry that: a) ensures costs are continually reduced, while b) avoiding adoption failures (situations (1) and (2) above). At a high level, this means designing a platform achieving the responses of Table 3.

Acquisition Failure	Platform Response
Buyer cannot afford asking price due to royalty stacking	Standard Term floors anticipate royalty stacking and purchase

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[129] *See, e.g.*, *About IMCA*, INT'L MARINE CONTRACTORS ASS'N, http://www.imca-int.com/about-imca.aspx [https://perma.cc/K443-5QME] ("IMCA is a trade association and exists for the benefit of its members across the offshore, marine and underwater engineering industry.").

[130] *See, e.g.*, *About NOIA*, THE NAT'L OCEAN INDUSTRIES ASS'N, http://www.noia.org/about/ [https://perma.cc/ZA4U-MEHV]:

> [NOIA], founded in 1972 with 33 members, represents all facets of the domestic offshore energy and related industries. Today, nearly 300 member companies are dedicated to the safe development of offshore energy for the continued growth and security of the United States. *Our membership also includes companies involved in or branching out to pursue offshore renewable and alternative energy opportunities*. (emphasis added).

[131] See GOLDSTEIN, *supra* note 87, *passim*, but particularly the discussion of FRAND licensing at pages 26-28.

	posture
Seller cannot afford asking price due to development costs	Ex ante coordination of Seller development; in rare cases, purchase subsidies may be used
Market demand fluctuates, affecting the asking price	Standard Term floors adjusted in accordance with proportionally weighted membership votes by both sellers and buyers
Patent-Holder refuses to grant reasonable or cost-effective licenses	Consolidated extra-territorial development; Monopsony buying patterns; Pooled defense fund

TABLE 3: Platform Failed-Acquisition Remediation

To create a platform achieving these responses, the designer should first craft a *Baseline Specification*.[132]

B. Baseline Specification

A Baseline Specification identifies the minimum viable technology adoption and implementation pathway necessary for the industry to remain economically viable. Ultimately, the specification will provide the basis for the platform's Standard Terms.[133] For example, let's say (this is a grossly coarse hypothetical example) that conservative estimates anticipate oil prices will remain at $55 a barrel and that communities require a break-even point for renewables installation at no more than 15 years from installation.[134] Let's further assume that operators require at least an 8% profit margin. Thus, to "remain economically viable" the industry must operate sufficiently beneath the established cost constraints (i.e., acquire oil at less than the market price and install renewables at costs within the break-even requirements) to achieve at least an 8% profit margin (naturally, many more factors would be considered in a real-world example). Rigorously considering these questions can itself provide a healthy assessment of the market, even if the developer decides not to pursue a platform.

Figure 10 is a graphical representation of the decision alternatives in a small

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[132] The term "Baseline Specification" is the Author's creation, though one can find implicit discussion of the same factors throughout Goldstein.

[133] *See supra* note 115 and accompanying text.

[134] *See, e.g.*, Taylor Johnson, *WindPower Profitability and Break Even Point Calculations*, Windpower Engineering & Development (Sept. 14, 2009), http://www.windpowerengineering.com/construction/projects/windpower-profitability-and-break-even-point-calculations/ [https://perma.cc/9EBT-SD2W].

portion of an adoption pathway, such as for an offshore installation service provider.

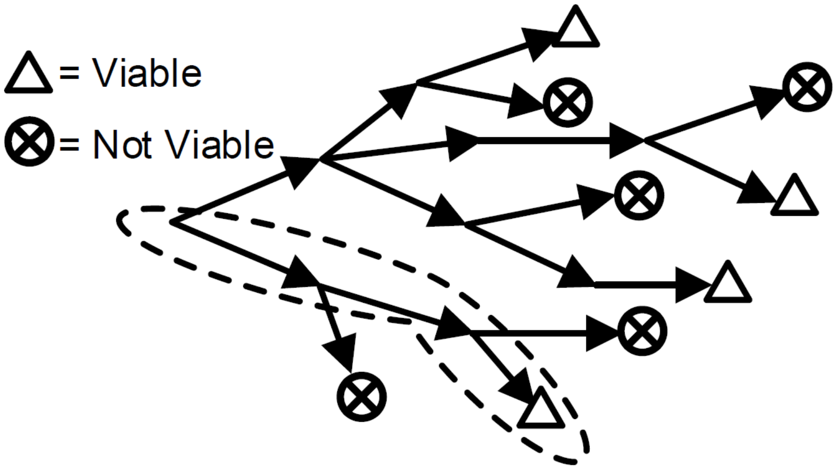

Figure 10: Decision Tree Structures for Technology and Implementation Pathway Identification

While illustrated as a decision tree to facilitate understanding, one will recognize that the developer would likely use a Monte Carlo, linear programming, or similar optimization method to identify pathways in a highly complex and correlated system with many random variables.[135] Additionally, since the market constraints are determined by the costs incurred by *all* sectors of the industry vertical, the pathways will need to consider factors outside the immediate sector in which the technology will be applied.

Assuming that the industry is mature enough, and the existing and future technologies sufficiently choate to make reasonable predictions, the developer should now be in possession of multiple technology adoption pathways each with varying degrees of viability. With the technology adoption pathways identified, the developer must now determine a plurality of implementation pathways for *each* of the technology adoption pathways. These pathways specify *how* the technologies will be implemented (outsourced, developed in-house, relevant IP is licensed, relevant IP is purchased, the product is developed extraterritorially, the product is manufactured locally, etc.) Again, these pathways will resemble the decision tree of Figure 10, with non-viable pathways pruned

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[135] Readers uncertain how to run such a simulation are invited to contact the Author, though examples appear throughout the systems optimization literature.

and removed.

Consider the following hypothetical and exceptionally simplistic example. The developer has determined that a viable technology pathway exists with technologies A, B, C, D and E. Technologies A and B require local, onshore assistance. Technologies C and D are substitutes. Technologies C, D, and E all have the potential for implementation outside US territorial waters. Thus, the developer should consider implementation permutations where C or D are used in different quantities and where one or more of C, D, or E are implemented entirely outside US territorial waters. Even in this simplistic example, there are rich possibilities, as the marginal cost to use E extraterritorially may fall if C and D are already developed and used extraterritorially.[136]

The remaining viable implementation pathways constitute the Baseline Specification, from which the Standard Terms are derived. In the worst case, platform members should be guaranteed the possibility of servicing their markets using at least one or more of these implementation pathways via the Standard Terms. The Standard Terms may be a "living document" that evolves with the needs and preferences of industry members. The following section discusses this evolving character in greater detail.

C. Intellectual Property Clearance and Standard Term Evolution

Once the developer has created an initial set of Standard Terms based upon the Baseline Specification, the developer must continue to monitor and adjust the specification and terms as the industry evolves. In the past, e.g., in telecom platforms, both market forces and member innovations have spurred this evolution.

For example, Figure 11 illustrates example levels of platform membership based upon the members' patent leverage.

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[136] E.g., having already requisitioned a foreign vessel to transport pylons from a foreign port, loading nacelles and transformers onboard may represent a *de minimis* additional cost.

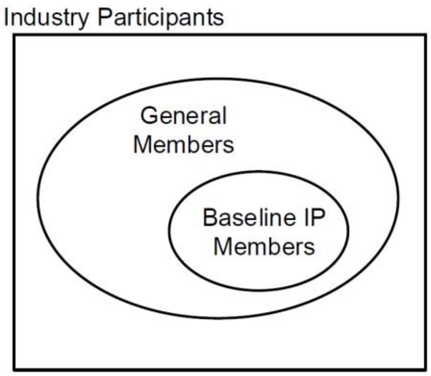

FIGURE 11: Platform Membership Groups[137]

As illustrated, not all participants of the industry are members of the Platform. Accordingly, these outsiders are not subject to, nor do they receive the benefits of, the Standard Terms. "General Members" are members of the Platform, but do not own Intellectual Property reading upon technology in the baseline specification implementation pathways. In contrast, Baseline IP members own blocking IP necessary to implement one or more of the pathways. Throughout its life, the platform must continue to remediate both internal patent blocks precipitated by platform members and external patent blocks precipitated by third parties.

1. Internal Intellectual Property Remediation

With regard to internal remediation, platform membership as a "Baseline Member" may accord greater influence on the future of the baseline specification and industry development. Accordingly, many IP owners, especially those with an IP interest in this area, may wish to become Baseline Members. Figure 12A illustrates an example application process for Baseline membership.

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[137] A corresponding discussion of membership in the 3G Platform may be found in GOLDSTEIN *supra* note 87, at 88-141, 270-303.

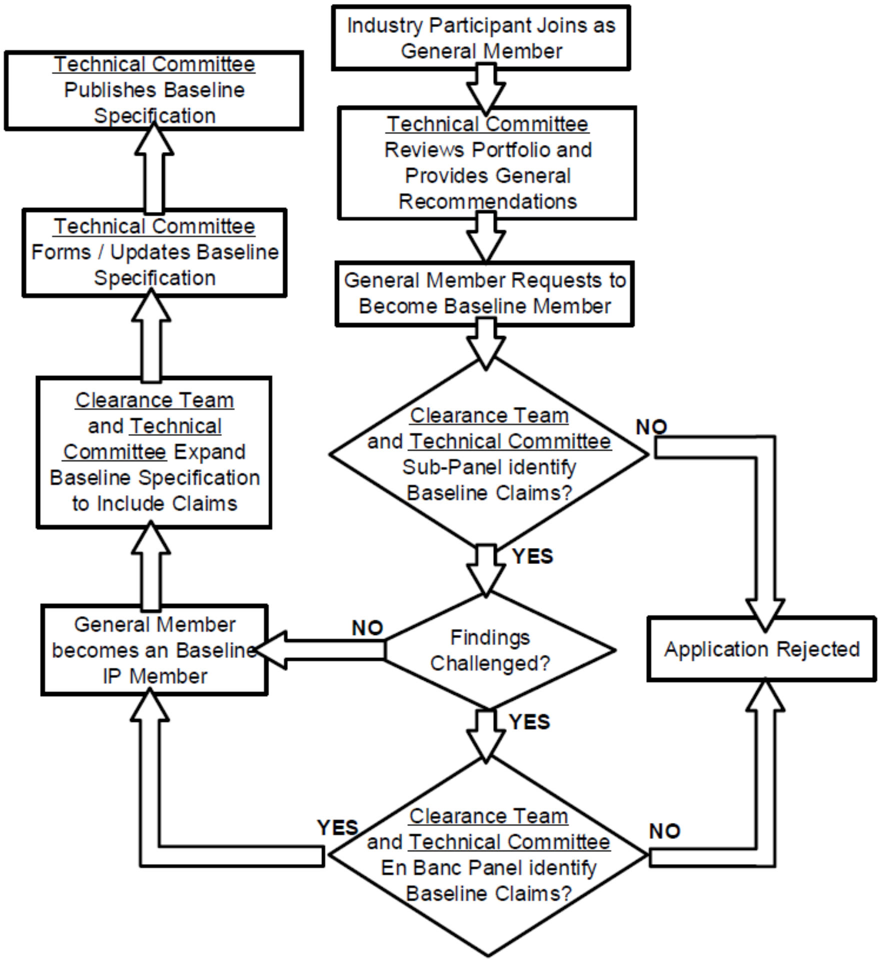

FIGURE 12A: Abstracted Example Internal Clearance Process

Industry participants may initially join the platform as “General Members”. They may then self-identify, or may be recognized by other members, as being in possession of IP blocking the baseline specification. The platform may comprise various committees especially selected to address various issues. A “Clearance Team” may identify blocking IP while the “Technical Committee” designs and publishes the baseline specification. A sub-panel composed of members from these committees may identify patent claims owned by the Applicant that read upon the Baseline Specification.

Naturally, as the Platform may make concessions to the Baseline Members to encourage licensing of their IP, acquiring status as a Baseline Member can be subject to some controversy. Thus, it's typical, e.g., in the Telecom industry, to include a process for challenging Baseline Membership decision.[138] In this example, challenges to the sub-panels decision may be reviewed by an *en banc* panels. Once the General Member becomes a Baseline IP member, the relevant committees may update the Baseline Specification to reflect the availability of the Baseline Member's IP.

2. External Intellectual Property Remediation

External Blocks may be remediated as indicated in Figure 12B.

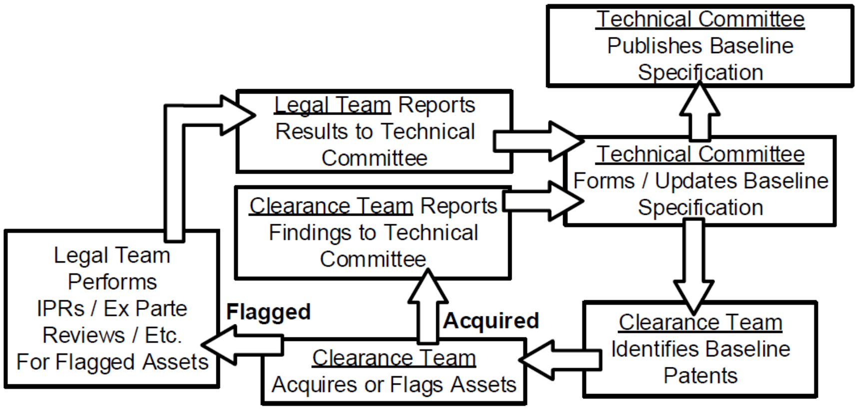

FIGURE 12B: Abstracted Example External Clearance Process

As indicated in Figure 12B, after a Technical Committee forms the initial Baseline Specification, the Clearance Team may identify patents and other blocking IP reading upon various implementation pathways. The clearance team can either "flag" or "acquire" this IP. For example, if the IP owner concedes to grant licenses on terms acceptable within the royalty stacking and other requirements of the baseline specification, the Clearance Team can proceed to acquire the license and report the successful acquisition to the Technical Committee. In some instances, the IP owner may simply become a Baseline Member of the platform. The Technical Committee can then update and publish a new Baseline Specification / Standard Terms reflecting these clearance results.

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[138] In lieu of platform panels, members may be more comfortable employing a third party. Consider GOLDSTEIN, *supra* note 87, at 91 ("The credible, neutral, third-party evaluator, is also called an 'Evaluation Service Provider' or 'ESP' for short.").

When such acquisition fails, however, the IP may be "flagged." Flagged IP is then referred to the Legal Team, which may perform an Inter Partes Review, Ex Parte reexamination, or otherwise take measures to eliminate the block or reduce its scope. The results of these efforts are likewise forwarded to the Technical Committee for inclusion in the Standard Specification. In extreme cases, the most economical choice may be to infringe the IP and accept any resultant consequences rather than proactively address the issue.[139]

3. Vertical-Based Leverage

The governance issues presented herein require careful consideration, certainly more than this brief Article can cover. Readers should appreciate at a high level, however, that Standard Terms, despite their neutrality, may implicitly confer leverage over some members than others. As evidenced in the hypothetical distribution of Figure 13, not only may the bargaining surplus afforded by the Standard Terms be different in different sectors, but the sensitivity to cost in each sector may vary.

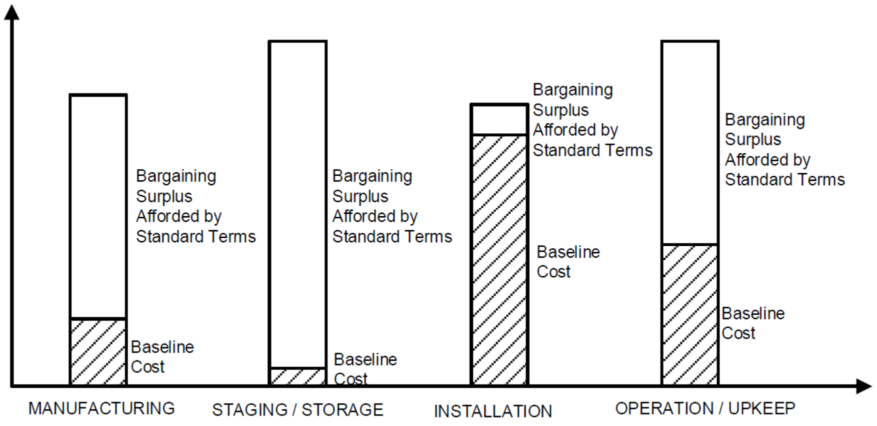

FIGURE 13: Abstracted Offshore Leverage Breakdown

Standard terms should vary with market posture to recognize the variation in bilateral agreements formed in different vertical segments. Thus, as in the railroads, governance structures and standard setting must realistically appraise the leverage and investment available to each platform member.

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[139] Different components in different verticals will have different practical lifespans, both in terms of utility and in terms of patent coverage. These disparities should also be addressed when considering industry-wide leverage.

CONCLUSION

The tension between efficiency and innovation imbues offshore energy, and can never be entirely resolved. Innovation, by its definition, implies the creation of alternatives disruptive to the existing order. However, those alternatives *can* be harnessed in a controlled manner. The final evolution of the American railroad is evidence enough of this possibility.

It is unclear how soon market factors will compel offshore operators to begin introducing the cost-cutting technology discussed herein. Certainly, the offshore energy industry, and the energy industry as a whole, already face many challenges warranting innovation. Given the industry's importance to the world economy, industry members should consider coordinating their efforts well in advance, at least so as to avoid the missteps of the past.