

## **An Effective Regulatory Regime For Transportation of Hydrogen©**

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### **Abstract**

Long distance transportation of hydrogen will likely rely upon interstate pipelines. This paper proposes a federal regulatory framework that would benefit such pipelines and prospective shippers by granting a regulator the rights to approve interstate hydrogen pipelines and to exercise certain authority over the rates and terms of service.

### **1. Introduction**

Hydrogen is being touted as a potentially prominent energy source in future years, with hydrogen supplying power to automobiles and even industrial facilities through use in fuel cells. [1] But if hydrogen is to become a prominent energy source, there may be a need for an extensive transportation network for delivering hydrogen to users throughout the country. In particular, hydrogen produced far from markets for consumption must be transported to such markets. Pipelines are the best option for this transportation, but building an extensive infrastructure of interstate hydrogen pipelines requires a strong regulatory regime providing rights and certainty to both pipeline owners and shippers. While the current regulatory regime for hydrogen pipelines, as described in Section 5 herein, may be adequate for the use of hydrogen for industrial purposes,

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the use of hydrogen as an energy source would require an appropriately tailored regulatory model.

An effective regulatory regime for hydrogen pipelines can draw from the regulatory regimes used for other types of energy pipelines in the U.S., particularly oil and natural gas pipelines. The basic framework of an interstate hydrogen pipeline regulatory regime would consist of: (1) vesting regulatory authority in a federal regulatory agency with experience in energy infrastructure regulation; (2) authorizing the regulator to approve proposed pipelines, which upon approval would receive eminent domain rights to acquire easements for the lengthy right-of-ways needed; (3) granting the regulator authority over the rates and terms of service of pipelines and the right to initiate investigations and enforcement actions; and (4) giving the regulator the flexibility to regulate pipelines consistent with the industry structure and business practices. Implementing legislation to adopt such a regulatory model will create certainty for all market participants and help facilitate the development of a hydrogen pipeline network.

## **2. The Benefits of Pipelines**

Long-distance transportation of hydrogen would be necessitated if hydrogen were produced at considerable distances from points of distribution to consumers. Under one scenario, hydrogen could be produced through electrolysis at remote locations, whether via renewable energy resources, nuclear power, or other means. For example, wind turbines in the Great Plains could supply power for the production of hydrogen through electrolysis. The hydrogen produced at such locations, which would be far from most major markets, would have to be transported to such markets using efficient and reliable means. Based on the widespread and successful use of pipelines in other segments of the energy industry, and, to a lesser extent, for hydrogen transportation, [2] pipelines are the best option for transporting hydrogen over long

distances when compared with other options (such as trucking and water carriers).[3] New pipelines have a life of several decades, and require relatively low maintenance and operational costs. They are more reliable and safer than alternative modes of transportation, and help avoid further congestion of highways and roads. The size and location of pipelines reflects customer requirements, and building large-diameter pipelines to serve multiple customers reduces the costs per customer. Being located underground, pipelines are relatively unobtrusive and quiet, and siting them in existing right-of-way corridors minimizes environmental disruption. In addition, because hydrogen is fungible, it lends itself well to pipeline transportation, under which shippers can deliver to and receive from the pipeline a certain quantity of the product, without needing to receive back the very same molecules. Accordingly, if hydrogen is produced in few locations but used in many, hydrogen pipelines may be needed.[4] However, the development of a large-scale hydrogen pipeline network requires an effective regulatory regime granting rights and protections to both pipelines and shippers.

### **3. The Advantages of Pipeline Regulation**

Regulation of pipelines results in benefits to both the pipelines and their customers. Regulation establishes a process whereby the necessary pipeline infrastructure can be constructed. Once constructed and in operation, regulation helps ensure that the pipeline recovers its costs. Regulation also protects shippers from discriminatory and unreasonable rates and practices that a pipeline could engage in if it had monopoly power.

#### **A. Facilitating Construction**

Properly designed regulation can facilitate the construction of a national network of hydrogen pipelines. Without such regulation, the barriers to constructing a large linear project

such as a pipeline might be insurmountable. To be constructed, a pipeline must acquire a right-of-way for its entire path, including laterals and appurtenances such as meter stations. This right-of-way needed for a pipeline is often hundreds or even thousands of miles in length. The main barrier to constructing pipelines is the acquisition of this right-of-way needed to construct, *i.e.*, site, the pipeline. Typically, pipelines acquire their needed right-of-way by purchasing easements in property owned by other parties. If a pipeline had to rely solely upon the market to acquire these easements, pipeline developers would have little leverage against individual landowners, who could demand exorbitant payments for the easements. This would make it economically infeasible to construct a pipeline. Regulation can eliminate this obstacle by conferring on pipeline developers' eminent domain rights for acquiring the necessary right-of-way.

In addition, regulation provides certainty to the pipeline and other interested parties. Well-designed regulation defines parameters setting forth the legal rights and the applicable process under which a proposed pipeline project will be evaluated by the appropriate regulatory agency. The certainty created by the regulatory framework is critical for a project sponsor to be able to attract capital investment for a pipeline. Furthermore, the hydrogen economy will involve local distributors who would receive deliveries through the pipeline for distribution to consumers. These local distributors would be more likely to invest or attract capital and initiate their own infrastructure projects if they had confidence that construction of the pipeline would not be compromised by regulatory uncertainty.

#### **B. Ensuring Fair Terms of Service and Preventing Anti-competitive Conduct**

Once a pipeline is in operation, economic regulation is often essential to help safeguard the transportation market. In general, economic regulation is often necessitated when a given

market cannot overcome certain structural problems in an industry. The structural problem often associated with pipelines is that they are natural monopolies, *i.e.*, large companies with high fixed costs but low marginal costs of production such that a single firm can produce a good or provide a service more cheaply than two firms could.[5] The high fixed costs result in a barrier to entry that deters competitors that are faced with the practical inability of duplicating such assets as pipelines or electric distribution networks. If the natural monopolist is not constrained by competitive market forces, it may possess market power, and, if unregulated, might charge prices that are high relative to the cost of providing the service. A pipeline with unconstrained market power can also discriminate in various ways against nonaffiliated shippers or discriminate in favor of larger shippers to the detriment of smaller shippers. Rather than disallow the monopoly (*i.e.*, on anti-trust grounds), one governmental response is to allow the natural monopoly, subject to economic regulation including rate regulation, and, in some cases, licensing approval for constructing facilities. By setting a level playing field, regulation helps avoid potential anti-competitive problems.

In the United States, all energy-transporting pipelines are subject to some form of economic regulation.[6] Early in the history of the oil pipeline and natural gas pipeline industries, the federal government determined that economic regulation was required. Within a few years of the discovery of oil in the United States in 1859, Standard Oil controlled much of the transportation, as well as the production and refining, of oil. By the 1880s, Standard Oil had a near total monopoly over pipeline transportation, and it used this monopoly to favor its own production to the detriment of its competitors.[7] Extensive natural gas pipelines developed a few decades later. Beginning in the 1920s, inexpensive natural gas from Southwestern U.S. producing areas became increasingly available to consumers throughout the U.S. due to the new

high-pressure, long-distance pipelines that could transport this gas. This led to rapid growth in both natural gas production and pipelines. Because of their key role in bringing gas to consumers, the pipelines gained market power.[8]

Based on the natural monopolies enjoyed by pipelines and their actual (or feared) exercise of market power by charging shippers excessive prices, the federal government enacted the Hepburn Act in 1906 to regulate interstate oil pipelines,[9] and the Natural Gas Act (“NGA”) in 1938 to regulate interstate natural gas pipelines. Although the two acts were premised on similar natural monopoly concerns, the acts differ substantially, in part due to the different industry structures. Most significantly, perhaps, oil pipelines provided only a transportation service, whereas natural gas pipelines owned the gas they delivered and thus provided both the transportation and the product itself.

The Hepburn Act amended the Interstate Commerce Act (“ICA”) and: (1) gave the Interstate Commerce Commission (“ICC”) responsibility for regulating oil pipelines[10]; (2) made most interstate oil pipelines common carriers;[11] (3) required that their rates be “just and reasonable”; and (4) banned undue discrimination among shippers. The ICC did not receive any authority over interstate oil pipeline siting and construction, nor any authority over the price of oil.

Unlike the Hepburn Act, the NGA was premised on a need to regulate the price of gas, which at that time was included (*i.e.*, bundled) with the price of the transportation. The NGA was intended to ensure a low rate for gas delivered from an interstate pipeline for distribution to end-use customers. Under the NGA: (1) all interstate transportation and wholesale sales of natural gas became subject to regulation by the Federal Power Commission (“FPC”) (replaced by the Federal Energy Regulatory Commission (“FERC”) in 1977); (2) all rates, charges and

practices had to be just and reasonable and approved by the FPC; (3) the FPC could upon request, or on its own initiative, investigate the rates and, if it found them to be unjust and unreasonable or unduly discriminatory, could reduce the rates to a just and reasonable level; and (4) FPC approval was needed for the construction or abandonment of any facilities used for transportation of natural gas in interstate commerce.

Within a decade, Congress amended the NGA to give gas pipelines eminent domain rights for pipeline construction. This was intended to prevent individual landowners from thwarting a pipeline project found to be in the public interest and responded to various state laws and state court decisions that denied interstate pipelines the right of eminent domain under state law.[12]

The present federal regulation of interstate hydrogen pipelines evolved from the original oil pipeline regulation. When Congress abolished the ICC in 1995, it transferred its remaining authority over pipelines to a new agency called the Surface Transportation Board (“STB”).[13] This authority included regulation of interstate hydrogen pipelines. As discussed below, this regulation is quite limited and inadequate for fostering the development of a large-scale hydrogen pipeline network. A more comprehensive statutory regulatory model, as proposed herein, would encourage development of a hydrogen pipeline infrastructure, mitigate the excessive rates that could result from the exercise of pipeline market power and prevent discrimination against shippers. This model can be based on aspects of the regulatory models for the natural gas and oil pipeline industries.

#### **4. The Regulatory Regimes for Existing Large-scale Interstate Pipelines**

Reviewing the regulatory regimes for natural gas pipelines and oil pipelines helps demonstrate the scope of a potential regulatory framework for hydrogen pipelines. The

respective statutory frameworks for regulation of oil and natural gas pipelines create basic principles rather than specific rules for regulation of these industries. For example, the NGA and ICA do not specify how transportation rates for these pipelines must be calculated. Instead, the regulator is given flexibility to devise rate schemes, provided that it ensures these rates are “just and reasonable” and in the public interest. A review of the regulatory regimes for natural gas and oil pipelines shows how regulators have responded, within the statutory framework of the respective Acts, to the problems in each industry. To understand these regulatory regimes, it is also helpful to examine the structure of each of these industries, which itself influences the regulatory regime that was adopted.

#### **A. Natural Gas Pipelines**

The natural gas industry is comprised of three discrete segments: production, transportation, and distribution. Engineering and economics combine so that natural gas can only be viably transported via pipeline and thus pipelines play an essential role in all three sectors. In the United States, there are over 100 interstate pipelines with more than 200,000 miles of mainline transmission, and over 60 intrastate transmission pipelines accounting for at least another 73,000 miles.[14]

Transportation pipelines connect networks of pipelines on the production and distribution side. There are thousands of natural gas producers, ranging from small entities to major multinational energy companies. Gas is extracted from underground reservoirs, most of which are in the Gulf of Mexico, central states, Rocky Mountain states and western Canada. Gathering lines, usually small-diameter pipelines that traverse short distances, collect the gas at the various wellheads in the production areas and deliver it to processing plants or directly into the large-diameter transportation lines. Gathering lines are exempted from FERC jurisdiction under the

NGA and are sometimes, although not always, regulated by the states. Local distribution companies (“LDCs”) receive natural gas from the transportation pipelines and distribute the natural gas through a network of distribution pipelines to end-users. In nearly all cases, the LDCs depend exclusively on interstate pipelines for receipt of gas. Even more so than interstate gas pipelines, LDCs are natural monopolies with captive ratepayers and are subject to strict rate regulation by state authorities. The transportation pipelines connect the production sector with the distribution sector. Most of these transportation pipelines are interstate in nature, but there are also purely intrastate pipelines, particularly in production areas such as Texas and Louisiana, which are usually regulated by the applicable state regulator.

Under the NGA, the FERC has exclusive jurisdiction over the rates, services and construction of interstate gas pipelines. FERC has revised its regulatory policy within the NGA’s framework from time to time, but major changes in the regulatory regime have also been prompted by legislation. For example, until the 1980s, interstate pipelines owned and transported gas, and resold the gas to distributors. However, in the 1970s, problems such as gas shortages arose in interstate markets, and as a result, legislation was enacted in 1989 that ended all remaining federal regulation of natural gas prices.<sup>[15]</sup> As a result, FERC restructured the industry; today interstate pipelines no longer buy and sell gas, but only provide unbundled transportation for their customers, which can include affiliates and non-affiliates.

Interstate pipelines are not common carriers, and only provide transportation for customers with contracts. The two main types of contracts are firm and interruptible. Firm transportation means that the shipper reserves capacity in the pipeline for its own use over a period that is usually many years, and is essentially guaranteed to receive service up to its contractual demand. Shippers pay fixed charges for this type of service, even during periods

when they do not ship any gas. Shippers with interruptible transportation contracts do not reserve capacity and the pipeline schedules the shipper's service request only when available, *i.e.*, when firm shippers do not use their full entitlements or if the pipeline has extra capacity. Interruptible service costs considerably less than firm service, since the pipeline can interrupt the service at any time.

The NGA also requires that all rates, charges and terms of service be "just and reasonable." All pipelines must have FERC-approved tariffs containing the terms and conditions of service and rates. Each tariff is unique to the operational circumstances and business practices of the pipeline, and continually evolves to respond to the needs of the pipeline and its shippers.[16] Under the NGA, FERC has the authority to approve, reject or suspend (subject to hearing and refund), any changes a pipeline proposes to its tariff. Such changes are proposed in FERC administrative proceedings, and each shipper has an opportunity to contest the proposed change. The NGA also gives FERC the authority to initiate, either on its own or upon complaint, an investigation into whether the rates, terms or conditions of service are not just and reasonable, or are unduly discriminatory, and if not, it can modify them to make them just and reasonable. Presently, all pipelines charge cost-of-service rates. There are presently no interstate natural gas pipelines (other than storage-only facilities) with market-based rate authority. Pipelines cannot charge any shipper more than the maximum rate in the tariff, but can charge a lower rate, provided such discounts are not unduly discriminatory.

Under the NGA, proposed pipeline projects require FERC approval. FERC grants such approval if it finds that the project is in the "public interest," a test devised by FERC.[17] FERC approval of pipeline construction also entails a comprehensive environmental review of the proposed project.[18] If FERC approves a proposed pipeline project, the pipeline obtains the

right of eminent domain with respect to that particular project to acquire easements at a fair market value for the approved pipeline right-of-way.

## **B. Oil Pipelines**

The oil industry also has production, transportation and distribution sectors. The most important difference from the gas industry is the existence of transportation alternatives to pipelines. In 1999, oil pipelines delivered approximately 68% of all shipments of petroleum, with water carriers accounting for 27%, and truck and rail the remainder.[19] Oil pipelines deliver the bulk of petroleum because they are the most cost-effective and, unlike water carriers, are not limited by geography. As of 2002, the interstate oil pipeline industry in the United States comprised more than 150,000 miles of pipeline owned by approximately 170 jurisdictional oil pipeline companies.[20] As with natural gas pipelines, jurisdiction is split between federal and state regulators, based on whether the oil is transported in interstate or intrastate commerce.[21]

Oil pipelines fall into two categories: transportation of crude oil and transportation of refined petroleum products. The production segment involves extracting crude oil and transporting it either through small-diameter gathering lines or by truck to a pipeline, barge or other large-scale collection point. Because not all crude oil is processed for market in the production areas, there are two types of oil transmission pipelines. A network of pipelines transports crude oil, mainly from Texas, the Gulf region and Alberta, Canada, to refineries located primarily in the Midwest for processing. Another network of pipelines transports refined products to markets throughout the U.S. As common carriers, oil pipelines do not take title to the oil, and transport on behalf of both affiliated and non-affiliated shippers. If the requests for capacity exceed the capacity available, the space is allocated on a non-discriminatory manner,

usually on a pro rata basis. The specific pro-rationing method used to allocate capacity must be stated in the oil pipeline's tariff.

Oil pipelines either terminate at refineries or at storage terminals, which may be owned by the pipelines or the customers. At this point distribution begins and it is almost always by either truck or barge since, unlike natural gas, there is no local distribution network of pipelines for delivery to end-users. As a result, unlike natural gas, the downstream markets in distribution are competitive and not price regulated.

Similar to the NGA, the ICA requires that rates charged for interstate oil pipeline transportation be "just and reasonable," but does not mandate the use of a specific type of rate. Until recently, most oil pipelines had cost-of-service rates. The Energy Policy Act of 1992 ("EPAAct") directed FERC to issue new regulations to adopt a more simplified rate methodology for oil pipeline rates.<sup>[22]</sup> The primary reason for a more light-handed mode of economic regulation likewise relates to the structure of the industry; there is inter-modal competition in oil transportation and potential market power abuses by pipelines can be countered by competitive transportation alternatives.

Pursuant to the EPAAct, FERC has adopted policies under which oil pipelines can use any of four main types of oil pipeline rate regulation: indexed rates, cost-of-service rates, settlement rates, and market-based rates.<sup>[23]</sup> Under indexed ratemaking, FERC publishes an annual inflation index. This number establishes a ceiling level for the upcoming year and the oil pipeline then computes its rate by multiplying the previous year's ceiling rate by the most recent index. Thus, if the ceiling rate increases, oil pipelines can increase their rates and when it decreases, they must reduce their rates. No oil pipeline can charge more than the ceiling level, unless it resorts to one of the other three rate setting methods. If an oil pipeline can show a

“substantial divergence” between its actual costs and the ceiling level so that the indexed rate is not just and reasonable, it can propose a higher cost-of-service rate. FERC will then commence a rate case, typically involving a hearing, to determine what the rate should be. Oil pipelines can also file settlement rates as rates for service, provided that the rate is agreed to by all shippers (for revised rates) or at least one non-affiliated shipper who will use the service (for initial rates). The final rate methodology is market-based rates. If an oil pipeline can demonstrate that it lacks significant market power in any discrete market, and FERC agrees, it can charge a market-based rate. FERC has no fixed test for how to determine whether the pipeline cannot exercise market power; rather the determination is done on a case-by-case basis. In practice, FERC often only permits the oil pipeline to charge market rates to certain delivery points deemed competitive, and does not grant blanket market-based rate authority.

Consistent with the ICA, and unlike interstate gas pipelines, oil pipeline construction is not under FERC’s jurisdiction and does not receive federal eminent domain rights. Instead, the states regulate all oil pipeline construction to varying degrees.

## **5. The Existing Economic Regulation of Hydrogen Pipelines**

The nascent interstate hydrogen pipeline industry is already subject to some regulation.[24] The Surface Transportation Board (“STB”), an independent agency within the U.S. Department of Transportation, engages in limited economic regulation over the rates and terms of service of interstate hydrogen pipelines, as well as various other pipelines that transport gases for industrial use.[25] The statute setting forth the STB’s pipeline authority [26] provides that the pipelines’ rates must be reasonable and non-discriminatory. The pipelines are to establish their own rates and practices, give this information to interested persons, and provide their services upon request. Rate increases can be made after 20-day notice to affected shippers.

The STB cannot itself initiate investigations, but can conduct investigations in response to complaints filed by any person, including a government authority. If after conducting a hearing, the STB concludes that a pipeline's rates or practices are not reasonable and non-discriminatory, the STB may set a new rate or practice for the pipeline. Injured persons also have recourse to civil litigation to enforce their rights against the pipelines. The STB does not have any authority over hydrogen pipeline construction. Also, unlike FERC's authority over oil and gas pipelines, the STB cannot on its own initiative investigate and alter the rates charged by a hydrogen pipeline.

The limited authority Congress vested in the STB may be adequate to regulate transportation of hydrogen as an industrial feedstock. However, for several reasons, this regulatory structure is likely inadequate to support the large-scale pipeline development that may be required in the hydrogen economy. First, the STB lacks jurisdiction over pipeline construction. Second, the STB lacks the necessary expertise to oversee development and operations of a national hydrogen pipeline grid. Despite having regulatory authority over interstate hydrogen pipelines, the STB is primarily a railroad regulator and lacks expertise in regulating the energy industry. Third, the STB does not have authority to initiate its own investigations and enforcement actions, and its approval is not required for rates and terms of service. As discussed in Section 3 above, such limited regulatory authority has not proven to be adequate for regulation of energy transportation; a stronger model than that presently in place would be necessary for the development of a hydrogen pipeline network.

## **6. An Effective Regulatory Regime for Hydrogen Pipelines**

To alter the regulatory regime currently vested in the STB, Congress would need to pass legislation.[27] Following is a model, based in large part on successful facets of the natural gas and oil pipeline industry regulation, that would establish an effective regulatory regime for hydrogen pipelines. As with the oil and gas pipelines industries today, the proposed model regulates only the transportation of hydrogen in interstate commerce, and not the price of hydrogen.

**A. Interstate Hydrogen Pipeline Regulation Should be Transferred to FERC**

The STB has jurisdiction over miscellaneous pipelines that transport substances that are not primary energy sources, and is not a regulator with energy expertise. Assuming that hydrogen pipelines will assume such a role, with hydrogen providing a competitive energy alternative to oil and perhaps eventually to natural gas, jurisdiction over these pipelines should be transferred to the same regulator. FERC is the agency with the most expertise in energy pipeline regulation, with a large staff experienced in oil and natural gas pipeline regulation, including rates and tariff terms and conditions, natural gas pipeline construction matters, as well as expertise in the National Environmental Policy Act (“NEPA”) review process which is required by nearly all large-scale linear projects. In contrast, the STB has few staff dedicated to pipeline regulation.[28] FERC is thus clearly the existing agency whose mission and experience is best suited for interstate hydrogen pipeline regulation.[29] Such a transfer of energy regulation to FERC would follow the similar transfer of oil pipeline regulation from the ICC, the STB’s predecessor, to FERC in 1979.[30] Vesting hydrogen pipeline regulation in FERC will establish a one-stop shop, where a single sophisticated regulator provides a forum for all parties with interests in hydrogen pipelines, and has authority to approve pipeline construction, with one set of uniform rules coast-to-coast for all interstate hydrogen pipelines.

**B. Interstate Hydrogen Pipeline Construction Should Be Authorized by FERC and Have the Right of Eminent Domain**

The authority the NGA gives FERC over interstate natural gas pipeline construction has proven to be a successful model and should be extended to hydrogen pipeline construction. The success of this model is demonstrated by the fact that construction of interstate natural gas pipelines (both new and expansion projects) has expanded to meet the increased demand for natural gas in recent years. From 1996 to 2000 alone, over 20,000 miles of new pipeline facilities (including many all-new pipelines) with over 20 Bcf of new capacity have been added to the pipeline grid.[31] Although it might become possible to convert existing natural gas pipelines to transportation of hydrogen, this is unlikely in the near term due to the continued strong demand for natural gas in the U.S.[32] Accordingly, the model proposed herein includes two key components: authority to approve interstate projects rests in a single regulator rather than multiple state authorities, and authorized projects receive the right to exercise eminent domain to acquire easements for the lengthy right-of-ways needed for the pipelines.

Interstate pipeline construction requires the acquisition of large amounts of right-of-way in two or more contiguous states. Without federal construction authorization, project developers must seek authorization from each state through which the pipeline will pass. A federal regulatory regime is more likely than a patchwork of state regulatory schemes to ensure projects are dealt with consistently and efficiently. A single federal regulator would have jurisdiction over the entire pipeline route, and would hold a single proceeding where all parties, whether proponents or opponents, would discuss the project's route, environmental impact, and other issues relating to the proposed pipeline.

The alternative to a single federal regulator would be a patchwork of different regulatory schemes administered by separate state regulators. Even when the various regulators might generally agree on the merits of a particular project, they would still be administering distinct laws, with different evaluation criteria and political considerations, and could achieve disparate results regarding pipeline routing and other issues. Such fragmentation of the regulatory process would be of particular concern in light of the public opposition to large infrastructure projects such as pipelines. Hydrogen infrastructure projects may draw opposition, as have other infrastructure projects, since general support for hydrogen usage will not necessarily translate into individual landowners' wanting hydrogen infrastructure on or near their property.

Subjecting interstate pipelines to state regulation would increase the ability of local populations to pressure their state agencies to disapprove particular projects. For example, assume there is a need for a pipeline extending from State A across State B to State C. Without a federal regulatory regime, the pipeline developer would need construction authorization from all three states. Opponents of the pipeline project might pressure any of the state regulators in a way that would threaten the entire project. For example, the regulators of State B might not approve the project if they fail to see how the proposed pipeline would benefit their state, even if the benefits to adjoining states were unquestioned. Such regulatory delays or obstacles occur frequently in other energy industries that rely on state siting approvals, such as electric transmission.<sup>[33]</sup> With increasing population growth in the United States and the accompanying increased NIMBYism, it is likely that local opposition to large infrastructure projects will increase. Routing a pipeline through a series of states could lead to vulnerability to intransigent regulators in given states.

The interstate natural gas pipeline industry encountered similar problems in its earlier stages of development. Pipelines met with difficulty in securing construction authorization due to local opposition and state statutes denying eminent domain rights to interstate projects. For this reason Congress added federal eminent domain to the NGA in 1947, thus allowing pipelines approved by FERC to acquire the necessary right-of-way without state interference. Similarly, granting FERC all necessary authorizations for siting of hydrogen pipelines would consolidate all siting discussions in one proceeding, where interested parties can raise and resolve their concerns. Similar to interstate natural gas pipelines, states should have no part in the pipeline approval process (aside from that already conferred by federal law, e.g. pursuant to the Clean Water Act).

Finally, the rates and terms and conditions of service for interstate pipelines would in any event be governed by a federal regulator because they involve interstate commerce.[34] As a result, efficiency concerns also support granting the federal regulator jurisdiction over the pipeline routing and construction.

**C. FERC Should Receive Authority Over the Rates and Terms of Service and the Right to Initiate Its Own Investigations and Enforcement Actions**

Similar to oil and natural gas pipelines, FERC should have the authority to approve or disapprove the rates and the terms of service on hydrogen pipelines. An absence of effective regulatory oversight might allow pipelines to enjoy excessive returns, exercise market power or otherwise discriminate against shippers or, alternatively, lead to the pipeline operator being exposed to monopsony power from a few key customers driving down its rates below its fixed costs and resulting in under-recovery and default. The filing of rates and terms of service with the regulator creates a forum where all interested parties can participate and advocate their

interests. Similar to oil pipelines, hydrogen pipelines might only infrequently change their terms of service and, in such case, these changes may be accepted with little procedure. FERC's authority should also include the ability to investigate and rectify unjust or discriminatory acts and practices not only on the request of outside parties but also on its own accord. The NGA authorizes FERC to initiate investigations without request by any other party and, upon a finding that a rate or practice is not just and reasonable, to replace it with a rate or practice that is just and reasonable. Granting the regulator this authority empowers it and requires it to be more proactive and vigilant with respect to the industry it regulates. FERC should have this authority for hydrogen pipelines.

**D. FERC Should Have Flexibility to Regulate Hydrogen Pipelines Consistent with the Industry Structure and Business Practices**

FERC should be granted the flexibility to adopt hydrogen pipeline regulation to the structure of the emerging industry and be able to modify it as necessary. Numerous issues are sure to arise as the hydrogen pipeline industry evolves, and it is essential that the regulator be empowered to help develop a hydrogen pipeline network consistent with the public interest without having to predict in advance what the rules of the industry should be. Granting FERC adequate rulemaking authority would ensure it could enact suitable regulations. Among the issues FERC should have flexibility to decide as the industry evolves are:

(1) Whether transportation must be provided on an open access basis, and if so, whether it should be provided pursuant to long-term contracts (like natural gas pipelines) or on common carrier terms (like oil pipelines). Similar to natural gas and oil pipelines, this would likely depend on whether transportation alternatives develop for hydrogen and the extent to which downstream markets are dependent upon pipeline transportation of hydrogen, and also on

whether it is appropriate and necessary for shippers to enter into long-term firm transportation contracts corresponding to natural gas firm transportation contracts.

(2) Whether rates must be based on cost-of-service or can be determined through different and more flexible means. This will depend on the availability of competitive transportation alternatives, and the nature of the relationship between the shippers and pipelines. Similar to oil pipelines, one possibility could be that the initial rates for new pipelines are set based on a cost-of-service model and then adjusted periodically through an index. Alternatively, hydrogen pipelines may be able to enter into settlement rates with their shippers that both parties agree to and these rates can be accepted by FERC. As with oil pipelines, market-based rates could be permitted, provided there are sufficient competitive markets for hydrogen transportation.

(3) What the test should be for approval of a proposed pipeline project. Similar to the NGA, the statutory framework would likely establish an approval standard based on the public interest or similar relatively general criteria, and pipelines would have to meet this test to receive construction authorization and eminent domain rights. FERC would be tasked with devising a precise test implementing the statutory language. This test could be based on demand evidenced by shipper contracts, or perhaps the importance of hydrogen as an alternative to fossil fuels could alone establish the public interest to construct hydrogen pipelines.

(4) What the rules and codes of conduct should be for dealings between affiliated pipelines and shippers (if applicable), to prevent the pipelines from granting preferences to affiliated shippers at the expense of non-affiliates. Natural gas and oil pipelines cannot give preferential treatment to their affiliates that are customers.

(5) What rules should govern miscellaneous other issues, including interconnections with other pipelines, the extent to which certain terms and conditions (*i.e.*, nominations, operational orders) should be standardized and adopted by all hydrogen pipelines, abandonment authority, reporting requirements, and accounting issues.

## **7. Conclusion**

Providing a sound regulatory framework with certainty and flexibility should help encourage the development of hydrogen pipeline networks. For at least two reasons, adopting legislation in the near term would be a helpful step for transitioning to the hydrogen economy, even though a large-scale hydrogen pipeline grid may be years away. First, the costs of creating the hydrogen infrastructure are very high, and adopting legislation to facilitate development of the hydrogen infrastructure is an achievable, low-cost step that will in turn facilitate investment and planning. An analogy can be drawn between such future planning and facilitation of a hydrogen pipeline network and the steps taken by Congress to facilitate development of the electric nuclear power industry through the adoption of legislation limiting the liability of nuclear power plant operators. This congressionally imposed limitation on liability allowed electric utilities to obtain privately underwritten insurance up to a certain level, with an industry liability fund and the federal government providing indemnification for amounts exceeding this private insurance (up to a certain cap on liability) for any claims arising from nuclear incidents. [35] Similar foresight by Congress with respect to hydrogen pipelines will provide certainty to developers of that needed infrastructure.

Second, establishing an appropriate regulatory framework, rather than relying on the existing rudimentary framework, will help ensure the development of functioning hydrogen transportation markets. Both the natural gas pipeline and oil pipeline industries were

inadequately regulated at the outset, and various pipelines in those industries took advantage of the regulatory void and engaged in anticompetitive conduct. As a result, Congress had to step in and respond to a crisis by enacting a new regulatory model, which then required the industry to adapt to the new environment. Establishing from the outset an appropriate statutory framework for hydrogen pipelines may preclude the occurrence of such a crisis.

The adoption of the model offered herein should allow for the development of the hydrogen pipeline infrastructure while leaving the regulator the flexibility to determine the remaining details of the regulation.

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1        *See e.g.*, National Energy Policy, Report of the National Energy Policy Development Group, (May 2001), 6-10 – 6-11. Hydrogen is currently used in various industrial applications such as oil refining (used to remove sulfur from crude oil), chemical manufacturing (particularly manufacture of ammonia and methanol, and food processing (used to hydrogenate liquid oils). The use of hydrogen for energy in such applications as fuel cells is still largely in the experimental stages, although Praxair, Inc. has recently announced that it now offers high purity hydrogen for use in fuel cells on a commercial basis. See Praxair news release, Praxair Introduces New Fuel Cell Grade Hydrogen, issued March 13, 2003, obtainable at [www.praxair.com/praxair.nsf](http://www.praxair.com/praxair.nsf).

2        Praxair, Inc. owns the only interstate hydrogen pipeline in the U.S., extending from Texas into Louisiana. Air Products has recently announced an expansion of its hydrogen pipeline in Texas to Louisiana by mid-2004, and thus may become interstate. See *Chemical Week*, p. 18, November 13, 2002. Both companies also own small intrastate hydrogen pipelines in several other states.

3        *See e.g.*, National Hydrogen Energy Roadmap, United States Department of Energy, November 2002, at pp. 13-16.

4        This paper does not attempt to address the technical requirements associated with hydrogen pipelines.

5        Richard Posner, *Economic Analysis of Law* § 12.1 at 343-45 (4<sup>th</sup> Ed. 1992).

6        Pipelines are also subject to other federal regulation. For example, the Department of Transportation's Office of Pipeline Safety promulgates safety regulations for nearly all pipelines (both interstate and intrastate). This includes pipelines transporting natural gas, oil, and hydrogen. See 49 U.S.C. § 60101, *et seq.* (1994).

7        Standard Oil had an almost complete monopoly over pipeline transportation that it used to benefit its upstream production and downstream refining operations. Control of the pipelines allowed Standard Oil to dictate the market price of crude oil charged by independent producers and restricted crude oil from reaching competing refineries. *See, e.g., Williams Pipe Line Co.*, 21 FERC ¶ 61,260 at 61,581 and notes 71 and 72 (1982).

8        The market power of gas pipelines was enhanced by two factors. First, the majority of the natural gas pipelines were owned by a few affiliated companies that also owned the natural gas supply. Second, the Supreme Court had held that states could not regulate the rates of natural gas sold in interstate commerce pursuant to the dormant commerce clause of the Constitution, and thus there was no regulation of the interstate gas prices or transportation. *See FPC v. Hope Natural Gas Co.*, 320 U.S. 591, 610 (1943).

9        The term "oil pipelines" refers to pipelines that transport refined petroleum products (e.g., gasoline, diesel fuel, fuel oil, jet fuel, propane) as well as crude oil.

10       Oil pipeline regulation was transferred from the ICC to FERC in 1977 in the Department of Energy Reorganization Act. Pub. L. No. 95-91, § 4(c), 91 Stat. 565 (1977), 42 U.S.C. § 7101 *et seq.* (1994).

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11 A common carrier can be defined as “any carrier required by law to convey freight without refusal if the approved charge is paid”. Black’s Law Dictionary, Sixth Edition, 1990.

12 See Senate Report No. 429, 80<sup>th</sup> Cong. 1<sup>st</sup> Sess. 1947, for discussion of the multiple states where eminent domain authority could not be granted to interstate pipelines.

13 ICC Termination Act of 1995, Pub. L. No. 104-88, 109 Stat. 803 (1995), 49 U.S.C. § 15101 *et seq.* (1994). The STB’s jurisdiction extends to pipeline transportation of a “commodity other than water, gas, or oil.”

14 Energy Information Administration, *Natural Gas Transportation-Infrastructure Issues and Operational Trends*, p. 1 (October 2001).

15 The wellhead price for natural gas sold to interstate pipelines was limited by regulation, thus gas was sold at higher prices into the intrastate market. Thus resulted in natural gas shortages and pipeline curtailments. Congress responded by passing the Natural Gas Policy Act in 1978, which gradually phased out producer price regulation. Pub. L. No. 95-621, 92 Stat. 3351 (codified as amended at 15 U.S.C. §§ 3301-3432 (1994)). Congress later passed the Natural Gas Wellhead Decontrol Act of 1989, which removed all remaining wellhead price controls by 1992. Pub. L. No. 101-60, 103 Stat. 157 (codified at 15 U.S.C. § 3301).

16 For example, there are extensive tariff provisions setting forth the rights of shippers to temporarily or permanently sell unused capacity to other shippers (known as “capacity release”). An industry group called NAESB also promulgates standardized pipeline business practices on such issues as nominations, capacity release and operational flow orders, which FERC then adopts by rule and incorporates into its regulations for all pipelines to adopt in their tariffs and follow.

17 FERC’s determination of whether a pipeline project is in the public interest has changed throughout the years. Prior to 1999, FERC mainly looked at whether the pipeline had shipper contracts for the new expansion capacity. In 1999, FERC adopted a new test, whereby it first ensures that new expansion projects are not subsidized by existing shippers. FERC then looks at whether the benefits of the project (which can be general demand for natural gas in addition to execution of shipper contracts) outweigh the adverse impacts on shippers on competing pipelines and landowners. See *Certification of New Interstate Natural Gas Pipeline Facilities*, 88 FERC ¶ 61,227 (1999).

18 As a federal agency, “any major federal action” undertaken by FERC is subject to the National Environmental Policy Act (“NEPA”) codified at 42 U.S.C. § 4321 *et seq.* (1994). Certification of pipeline projects qualifies as a major federal action and, pursuant to NEPA, FERC is required to draft and issue for public comment an environmental impact statement (or environmental assessment for smaller projects) for nearly all pipeline construction projects.

19 Association of Oil Pipe Lines, *Shifts in Petroleum Transportation*, 2000.

20 Information obtained from FERC Form 6 “Annual Report of Oil Pipeline Companies” forms filed in 2002.

21 One large difference is that both states and FERC can regulate the same pipeline, with the states regulating the rates of the intrastate shipments of commingled crude oil shipments produced in that state. In contrast, there is no dual rate jurisdiction over interstate gas pipelines. See *Amoco Pipeline Co.*, 62 FERC ¶ 61,119 (1993).

22 Energy Policy Act of 1992, Pub. L. No. 102-486, 106 Stat. 2776 (1992).

23 The EPAct declared that all rates for oil pipelines in effect (and not subject to protest, investigation or complaint during the prior year), were “just and reasonable.” EPAct, § 1803 (a)(1). These rates thus became the baseline for subsequent FERC rate regulation.

24 See *supra*, note 2 for description of the current interstate hydrogen pipeline industry.

25 The STB regulates 21 pipelines that transport, respectively, anhydrous ammonia, carbon dioxide, coal slurry, phosphate slurry and hydrogen. Only the coal slurry is used to directly produce energy. See General Accounting Office, *Surface Transportation Issues Associated with Pipeline Regulation by the Surface Transportation Board*, GAO/RCED-98-99, April 21, 1998. (“GAO Report”)

26 See *supra*, note 13.

27 Congress would have to determine whether to include within the scope of such legislation all hydrogen pipelines, or to leave for state regulation pipelines that are considered to transport hydrogen only in intrastate commerce. If the latter occurs, states would enact regulatory regimes for such intrastate pipelines, as has happened in the natural gas pipeline industry.

28 Less than 2 full-time staff positions are devoted to pipeline regulation at the STB. See *GAO Report* at p. 8.

29 It bears noting that FERC has already disclaimed jurisdiction over anhydrous ammonia, and the other products subject to STB jurisdiction on grounds that Congress did not deem them important energy sources. See *Gulf Central Pipeline Co.*, 50 FERC ¶ 61,381 (1990). FERC’s reasoning was affirmed in *CF Industries, Inc. v. FERC*, 925 F.2d 476 (D.C. Cir. 1991).

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30     *See supra*, note 10.

31     *Supra* note 14, at p. 5-8. It should be noted that oil pipelines have been built under state, rather than federal, authorization. However, very few new oil pipelines have been built in recent decades.

32     Growth in natural gas demand is expected to increase from 22.8 trillion cubic feet in 2000 to 34.7 trillion cubic feet by 2020. *Annual Energy Outlook, 2003-with Projections to 2025*, prepared by Energy Information Agency, Office of Integrated Analysis and Policy, January 2003, at p. 77.

33     For example, it took American Electric Power Corp, a large electric utility, 12 years to obtain permits for a 90-mile electric transmission line from West Virginia to Virginia, due to opposition to the project from local interests. See Marianne Lavelle, *Power Grab*, U.S. News and World Report, August 6, 2001. Also, the Cross Sound Cable, a mostly underwater high-voltage DC electric transmission line connecting Long Island and Connecticut has been repeatedly delayed by the opposition of Connecticut State Authorities, on grounds that it only benefits New York. The cable has not been allowed to operate due to a moratorium passed by the Connecticut legislature. See Linda L. Randell and Bruce L. McDermott, *Chronicle of a Transmission Line Siting*, Public Utilities Fortnightly, January 1, 2003. A possible solution to the difficulties of siting new transmission lines would be to grant a federal regulator siting authority; however, such proposals have invariably been met with opposition from states. Presently, the House of Representatives has included backstop federal siting authority by FERC for interstate electric transmission lines in its version of a comprehensive energy bill. See Title VI-Electricity, section 216, H.R. 6, Energy Policy Act of 2003, passed by full House on April 11, 2003. The Senate passed a separate energy bill without electric transmission siting authority and a conference committee will be convened in September 2003 to reconcile the differences and produce one energy bill.

34     *See, e.g., Missouri ex rel Barrett v. Kansas Natural Gas Co.*, 265 US 298 (1924).

35     This statute is known as the Price-Anderson Act, 42 U.S.C. § 2210. The Supreme Court upheld the constitutionality of this act in *Duke Power Co. v. Carolina Environmental Study Group*, 438 US 59 (1973).