NERA
Economic Consulting

Energy Regulation Insights

August 2009
Issue 36

From the Editor

The shift to a low carbon economy will require the energy sector to adopt new technologies. The UK government, among others, is keen to find a space for Carbon(-dioxide) Capture and Storage (CCS).

The Department of Energy and Climate Change (DECC) asked NERA to describe a regulatory regime that would promote efficient development of the pipelines needed to transport CO2 from capture to storage. This article, which originally appeared in *New Power* (Issue 7, August 2009 - see newpowerconsulting.com), summarises the analysis in our report for DECC.

It is possible to preserve the efficiency-enhancing properties of competition in pipeline construction. However, to do so, pipeline owners must accept certain obligations to match contract capacity to pipeline capacity. Efficient investment is a paramount concern for the new CCS business, but our findings apply to any gas pipeline system.

—Graham Shuttleworth, Editor

How to Make Competition Work for Future CO_2 (and Other) Pipelines

By Graham Shuttleworth

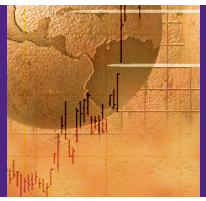
Background

The Department for Energy and Climate Change (DECC) recently asked NERA to review possible regulatory frameworks for pipelines that will be used to transport CO_2 from "carbon capture" to "carbon storage" – i.e., to describe possible regimes for the missing "T" in "CCS" (Carbon Capture, Transport and Storage).

The main question concerned the need for intervention or funding by government, which many commentators have been demanding. In the course of our study, we disentangled two factors that previous studies tend to merge: (1) the externalities of CO_2 abatement (which require some form of government intervention) and (2) economies of scale (which do not).

To create a demand for CO_2 pipelines, investors must see some value in storing CO_2. Creating such a value requires government action to bring CCS within the EU Emissions Trading Scheme (EU ETS) and/or other environmental incentive programmes. However, it looks like investors can cope by themselves with economies of scale in CO_2 pipeline construction. Drawing on existing regimes, our report[1] sets down conditions that preserve competition in the construction and use of gas pipelines and avoid the need for monopoly provision.

Keen observers may note that these conditions apply to any gas pipeline. Although our study for DECC is limited to CO_2 pipelines, it does raise questions about the future regulation of CH_4 pipelines (i.e., transportation of natural gas).



Some Simple Economics

Environmentalists often point to environmental damage as a reason why competitive markets don't work. Economists say the problem comes from no one owning the environment that is being damaged. The environment is a resource and its (ab)use is an "externality" – i.e., a cost that falls outside the market. The "Coase theorem" maintains that competitive trading will produce an efficient solution to externalities, if it is possible to create property rights over the externality.[2] We therefore began our investigation by checking whether the necessary property rights existed, or would need to be created.

Environmental Externalities

Emitting CO_2 is a problem if no one pays the cost of the resulting damage to our planet. Making CO_2 emitters pay the cost, by creating "Coase-style" property rights, provides an efficient solution to this problem. The EU ETS aims to achieve that goal, by giving particular traders a limited right to emit CO_2 into the atmosphere (effectively a property right over the CO_2—absorptive part of the atmosphere). Trading these "emissions allowances" puts a price on each emission and teaches everyone the cost of the damage. The allowed level of emissions may be right or wrong, but trading of emission allowances lets users find the most efficient way to limit CO_2 emissions.

The problem for CO_2 pipelines (and CCS in general) is the limited coverage of the EU ETS. Only this year, various new EU Directives have brought CCS within the EU ETS, by letting emitters of CO_2 avoid the need for an emissions allowance if they put the CO_2 into validated and secure storage. That creates a demand for CCS (and CO_2 pipelines) so long as the EU ETS lasts. However, the EU ETS does not yet extend beyond 2012, the end of Phase II. Because of the lack of longer term property rights over CO_2 emissions, the EU ETS understates the incentive to build CCS. In addition, the UK Government has, for whatever reason, adopted a number of policies that put a higher short term value on CO_2 abatement than the current price of an EUA.

The absence of long term markets for EUAs and the short term distortions caused by support for other measures both mean that the UK Government will have to provide additional (or longer term) support to CCS—not just to CO_2 pipelines—if it is to compete efficiently with other methods of CO_2 abatement. Long-term support may require long-term financial commitments, in order to be credible. So far, so interventionist.

However, there are no "network externalities" in a gas pipeline. It is possible to define the capacity offered by any section of pipeline *independently of other parts of the system* (given some basic operational data, such as operating pressures). In this respect, gas pipelines are unlike electricity networks. Providers can compete to offer discrete pieces of pipeline.

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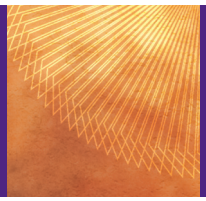

Economies of Scale

The second major topic of our study was economies of scale. DECC had heard many claims that large pipelines provide capacity more cheaply (per unit) than small pipelines, and that centralised provision was more efficient than decentralised provision. The questions facing us were whether CO_2 pipeline economics mean that: (1) bigger is better and (2) monopoly is best of all. The answers are "no and, hence, no".

In a companion study,[3] engineers from Parsons Brinkerhoff (PB) looked at the likely future development of CO_2 pipeline infrastructure. Drawing on earlier work with the "Merkal" model, their work highlighted the key economic features of such forecasts. With regard to supply, the efficiency of building ever larger offshore pipelines is constrained by availability of pipe-laying ships and by the need to aggregate loads over ever wider areas. Economies of scale in the construction of offshore pipelines therefore diminish rapidly for pipelines with a diameter above 36 inches.

On the other hand, future demand for CO_2 storage (and hence CO_2 pipelines) is highly uncertain, but is likely to rise in small increments separated by long periods.

Some may see uncertain future demand as a case for government intervention or monopoly provision. However, there is no evidence that either governments or monopolies deal more efficiently with uncertainty than decentralised, competing investors. Some may argue that monopoly provision of large pipelines would be more efficient than adding capacity in small increments, but we found that the opposite was true—if demand is uncertain and additions to demand are infrequent, adding small pipelines is *more* efficient than building a huge pipeline ahead of demand.

These findings reduce concern about the need to capture economies of scale. Competitive construction of small incremental pipelines will offer an efficient way forward. However, existing pipeline owners might still have an advantage, if they can add capacity relatively cheaply. Unrestricted competition would quickly collapse into *de facto* monopoly, if the "first mover" always becomes the "first port of call." So what rules would preserve competition in pipeline construction?

How to Preserve Competition in Pipeline Construction

We studied a number of pipeline regimes and found two that provided particularly useful examples. The UK's regulatory regime for offshore natural gas pipelines already permits provision by competing pipeline owners. Comparison with the US federal regulation of natural gas pipelines suggested some possible adjustments—each of which takes the regime closer to Coase's regime of tradeable property rights. Putting these regimes together, we suggested the set of rules for regulating CO_2 pipelines set out in the Boxes below.

The rules in Box 1 ensure that investors coordinate project development efficiently, to maximise economies of scale.

Box 1: Rules to Facilitate Efficient Project Development

1. ***Open seasons:*** Pipeline developers can form joint ventures voluntarily, but should be required to publicise their projects and offer others a chance to join via open seasons, in order to maximise the scope for exploiting economies of scale.

2. ***Negotiated division of incremental costs:*** The UK offshore regime allows additional participants to demand access to a project at the incremental cost of accommodating that user, which disadvantages anyone who signs up to pay a share of the fixed costs of a project. The users of a project should pay the incremental costs of the project itself, but rules on the division of costs between users are not efficient or necessary and would hinder the development of competition. Participants should negotiate whatever division of costs makes sense to them.

Box 2 contains the rules on contract design, which ensure that investors can see the characteristics of the pipeline they are paying for.

Box 2: Rules on Contract Design

3. ***Long-term contracts for point-to-point capacity:*** The most important rule for meeting the Coase conditions is to ensure that pipeline developers offer contracts (i.e., property rights) that look like the underlying assets. Like pipelines, such contracts would offer a defined level of capacity to move gas from one point to another (with intermediate stopping off points, as necessary) and would last at least as long as it takes to recover the costs of the project. After the developer has recovered its costs, contract holders would choose whether to roll over their contracts for another (multi-year) period or to let the capacity revert to the pipeline developer.

4. ***Straight fixed variable pricing:*** To maintain the link between contracts and the underlying assets, all fixed costs of construction and maintenance should be recovered through capacity charges, while the variable costs of moving gas should be charged on a volumetric basis. Regulation on tariffs on this basis (now or in the future) requires the careful regulation and compilation of regulatory accounts from day one of any project.

The rules in Box 3 promote efficient use of existing capacity (and hence efficient investment in new capacity).

Box 3: Rules to Promote Efficient Use of Capacity

5. ***Unbundling:*** In case anyone is unaware of recent debates in Europe on transmission access, we suggested that separation of pipeline ownership (developers) from pipeline usage (contract holders) would improve the efficiency of usage and promote more competition in capacity trading. Pipeline owners would be landlords, owning a facility and collecting the "rent," but would not occupy any of the space they owned.

6. ***Common platform for pipeline users to trade capacity:*** It would also be efficient to make pipeline owners create a common system for trading capacity, long term and short term. Facilitating frictionless trade is a key component of the Coase conditions. It encourages efficient use of existing capacity and provides a way for new players to take over capacity (surely, the real intention of Third Party Access). It also allows a market price for capacity to emerge. High market prices for existing capacity provide an efficient spur to investment in new capacity.

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Finally, to preserve competition, we needed to overcome advantage of existing pipeline owners as the "first port of call". Suppose a pipeline runs from A to B to C to D (e.g., from one onshore CO_2 collection point at A to three different CO_2 storage fields at B, C, and D). Capacity may only be constrained (i.e., facing excess demand) between B and C. The obligation to offer taps set out in Box 4 allows any pipeline developer to build a new pipeline (a "loop") from B to C.

Box 4: Preserve Competition for Capacity Expansions

7. ***Obligation to provide "taps":*** Both the UK offshore regime and the US gas pipeline regime impose an obligation on existing pipeline owners to offer "taps" (T-junctions or connections) to other pipelines.

Capacity trading allows a market price to emerge for the constrained section of the pipeline. The ability to identify and expand highly valued capacity *only where capacity is tight* (B-to-C) avoids the need for competitors to invest in unnecessary duplication of spare capacity (A-to-B and C-to-D). Such opportunities arise when contract terms reflect the underlying assets (point-to-point capacity, straight fixed variable pricing, incremental pricing for the project as a whole). Competitors have no similar opportunities under "network" definitions of capacity (like entry-exit) that abstract from the flow of gas through individual pipelines.

Summary: Policy Choices for Pipelines Transport CO_2 (and Other Gases)

No one will build or use CO_2 pipelines unless investors have sufficient incentive to abate CO_2 emissions by storing CO_2. Only government intervention (by the UK or at EU level) can put a value on (or guarantee the future value of) CO_2 storage. The most efficient policy is to create "Coasian" property rights over the externality, by bringing CO_2 storage into the EU ETS. Any further support by the UK Government will achieve efficient outcomes, if these measures meet the same Coase conditions.

All the rules from 1 to 7 listed in Box 1 are needed to meet the Coase conditions for CO_2 pipelines. Our study offers the UK Government some choices, as we acknowledged that economic conditions may change and that policy makers may take a different view on the desirability of preserving competition in the construction and use of pipelines. However, reader, be warned: dropping any one of the rules means a departure from the Coase conditions

Our Practice

NERA is at the forefront of the continuing transformation of energy industries worldwide. Our experts have developed approaches for introducing competition in segments such as power generation and gas supply, where competition is workable, and for improving the regulation of sectors where it is not. We work with companies, governmental bodies, and regulators worldwide to design competitive gas and electricity markets and to develop tariffs and rules of access for regulated transmission and distribution systems for electricity and gas, and the transport of oil and oil products.

NERA helps companies develop strategies for exploring new opportunities and minimising new risks, including issues related to climate change and other environmental initiatives. We also help our clients to develop new regulatory strategies, and support them with analysis and testimony before regulatory commissions, antitrust and competition policy agencies, and domestic and international courts.

Our work includes designing and conducting energy auctions and providing strategy and valuation advice on mergers and acquisitions, the financing of energy companies, and the financial restructuring of distressed companies.

and the *de facto* abandonment of efficient competition in pipeline construction. Adoption of an "entry-exit" definition of capacity would be particularly destructive to competition, since it breaks the link between capacity contracts (property rights) and actual pipeline assets. An entry-exit regime blocks competitive entry, entrenches the position of incumbent pipeline operators, and creates a need for more regulation and more complex regulatory rules.

The UK Government is consulting widely on the possible regime for CO_2 pipelines and CCS in general. The UK therefore still has a chance to adopt proposals that promote efficient, competitive provision of CO_2 pipelines. Some may also see important lessons in these proposals for pipelines transporting natural gas.

EndNotes

1 NERA (2009a) and (2009b), *Developing a Regulatory Framework for CCS Transportation Infrastructure*, Vol 1 (Main Report: URN 09D/596) and Vol 2 (Case Studies: URN 09D/597), 11 June 2009 (available via www.decc.gov.uk, under Publications/Carbon abatement technologies, and via www.nera.com).

2 The theorem, attributed to economist Ronald Coase, states that when (1) property rights over a resource—like an environmental externality—are clearly defined, (2) frictionless trade in the externality is possible and (3) the market is fully informed about the supply, demand and prices for the resource, bargaining will lead to an efficient outcome regardless of the initial allocation of the property rights.

3 PB (2009), Technical analysis of carbon capture & storage (CCS) transportation infrastructure (URN 09D/595), Parsons Brinckerhoff Ltd, May 2009 (available via www.decc.gov.uk, under Publications/Carbon abatement technologies).

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