THE STAKES ARE HIGH FOR A PHILADELPHIA ENERGY HUB

In Search of Better Outcomes for All

by Mark Alan Hughes

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Let's start with the question, what is an energy hub? It is a question that is almost never asked. The "Philadelphia energy hub" is stuck in the promotional stage of the issue attention cycle, in which boosters and doomsayers all try to create a narrative that benefits a strategic interest. And more power to them.

But that skillful framing skips past basic questions like, what exactly are we all even talking about? In this policy digest, we try to examine some basic definitional questions in order to advance the public conversation and, especially, to provide a way into that conversation for the large majority of people and interests now on the sidelines.

What is an energy hub? Let's start with what it is not. An energy hub is not a business plan. That means it is not just about building pipelines to bridge an infrastructure gap that would benefit a limited set of firms. Nor is an energy hub a sectoral strategy. That means it is not just about a set of inter-industry connections creating a value chain stretching from upstate and upstream gas wells to gathering pipelines to processing and storage facilities to transmission pipelines to more processing and storage facilities to distribution pipelines to consumers of fuel and feedstock to producers and consumers of intermediate and final products. Both of these narrow definitions leave potential gains on the table and potential partners wondering whether they are for it or against.

An energy hub creates value by connecting things in ways that makes them worth more than the sum of the parts. The hub is, if you will, the center of a wheel connected to gears that transform the same pedal power into higher speeds. Being an energy hub would change what jobs people do here or not, what research and discoveries happen here or not, why people come here to study or visit or not, who moves or stays here or not. All these things happened the last time Philadelphia was an energy hub, during the 75 years or so after 1850.

So to have a real discussion about a Philadelphia energy hub, we need to move beyond simplistic references to good things like "a manufacturing revival" and bad things like "an environmental sacrifice zone". Here are three sets of questions that must be part of any serious energy hub strategy.

First, every booster of the Philadelphia energy hub pitches prosperity to the public in the form of job creation, payroll expansion, and local spending multipliers. We can ask many questions of that pitch. Let's pose just one. What will it take to ensure that Philadelphians are well-qualified applicants for those jobs? The "energy hub" answer to that question implicates our education and workforce development systems. We need to ensure that resourcing worker readiness is as high a priority as resourcing infrastructure to raise the returns to investors.

Second, every booster of the Philadelphia energy hub pitches environmental protections to the public in the form of adequate standards and practices. We can ask many questions of that pitch. Let's take just one. How will we know that standards for, say, climate-changing methane leakage in the natural gas supply chain are being met, regardless of what those agreed standards are? The "energy hub" answer to that question implicates our regulatory and enforcements systems. We need to ensure that the capacity to monitor and protect our regional air, water, and land amenities is an integral part of an energy hub strategy.

Third, every booster of the Philadelphia energy hub pitches safety to the public. Again, let's ask just one of many questions. What is an acceptable level of exposure to low-probability, high-consequence events to residents and businesses? The "energy hub" answer to that question implicates our advocacy and legal systems. We need to ensure that sufficient transparency and monitoring is in place to address community concerns.

What each of these examples has in common is a set of disputed facts people might argue over. How many jobs? How much air pollution? How often will things blow up? For that matter, how much gas is really in the Marcellus Shale play and how do we know if it's really enough to justify some huge number of dollars in public investment?

Planners and economists typically promote careful analysis to provide estimates of these kinds of projections. But dueling forecasts rarely if ever settle such a contest. More importantly, who bears the liability if the numbers are wrong? If the region is promised jobs in return for taxpayer funding, then what is the remedy if those jobs don't appear? Same for a bankrupt pipeline, water contamination from long-closed mines, etc. There need to be ways to claw-back both public subsidies and concessions made by community and advocacy groups in order to allocate fairly the costs and losses if pipelines turn into pipedreams.

It's not simple to design and build these kinds of "enforceable partnerships," of course. Right now, however, we have no productive dialogue on the risks and rewards of a Philadelphia energy hub. We have two monologues: one saying "absolutely yes" and one saying "absolutely no." The extremes have a right to state their yes or no positions, and personally I'm glad to have them both on the scene. But the question for the large majority of us is not, yes or no? The question is, under what conditions?

Can we turn a "yes or no" debate in which blunt instruments of power are likely to produce either a pyrrhic victory or a stalemate into an "under what conditions" debate in which legitimate concerns are accommodated in ways that advance the whole region on a sustainable pathway to a better future. This goal requires a delicate dance between analysis and compromise—toward a coherent strategy for using natural gas as an economic development driver for the Philadelphia region. To organize this argument, I'm going to use the "bridge to the future" metaphor, which is an old standard with respect to natural gas. But the bridge metaphor is almost always rolled out in an insipid and unhelpful way. We can get a lot more work out of the image.

Natural gas as a "bridge to the future" conveys a transition that helps decarbonize our energy system over time. That transition is often stated specifically as a move away from more carbon-intensive coal and toward carbon-free renewables in the future. But that's just a specific case; there are other transitions that could potentially decarbonize the energy system. If carbon capture and sequestration (CCS) technology, for example, became feasible tomorrow, then we could decarbonize by burning coal without carbon emissions and not need a gas bridge. Alternatively, if grid-scale energy storage technology became feasible tomorrow, then we could integrate massive renewables into our energy system and again not need a gas bridge. In each case, it's the transition that matters not the means of the transition.

The reason natural gas makes a powerful claim as a necessary bridge to the future is that CCS, renewables, storage, energy efficiency and every other option alone or in combination almost certainly takes more time to implement than we have to avoid the worst consequences of a carbon-intensive energy system. (These consequences are outlined in many studies, but for a bi-partisan and establishment version, see Risky Business.)

But just calling natural gas "a bridge" doesn't make it one. It's time—past time—to design this bridge with at least as much seriousness as if we were planning to literally drive across one. Major design choices must go into a bridge before it can be built and used. Where do we get on and where do we get off? How long is it and what's the speed limit? How much weight does it bear? What's the toll charge? And once we're across it, where does it connect us with and where have we bypassed?

So far, the Philadelphia energy hub debate has been dominated by narrow (which is not to say unimportant) interests. It's like a bridge being designed by a bridge-painting company. They wouldn't care about all those questions above; they'd only want a bridge that is ready for the next repainting as soon as the last repainting is completed. We need to design a bridge that serves everyone, not just the bridge painters.

The first principle of this design effort should be that no assumption is above interrogation. For example, why isn't carbon-based natural gas a total non-starter for anyone who believes in climate change and its risks? Fair enough.

A January 2015 study published in *Nature* provides a helpful answer. Informed by science over decades and from around the world, policy makers from every nation agreed in 2009 that average global temperatures should not be allowed to increase more than 3.6 F degrees (usually measured as 2 C degrees) above normal temperatures before industrialization. The accepted estimate for having at least a 50 percent chance of staying below that dangerous threshold states that the total additional amount of carbon emissions added to the atmosphere between now and 2050 cannot exceed the emissions contained in about one-third of the world's fossil fuel reserves. ("Reserves" are the economically feasible fraction of "recoverable resources," which are the much larger amounts of fossil fuels known to exist.) All this says what we've known for a few years, that about two-thirds of economically viable fossil fuel reserves must remain in the ground in order to stay under the 3.6 F threshold.

What's new and interesting in the *Nature* paper is that the authors ask which two-thirds should be left in the ground as "unburnable"? Using well-established models that run both economic and climate data, they identify the most cost-effective one-third to burn before 2050 in order to stay under the 3.6 F threshold. For the whole world, they estimate that 33 percent of oil, 49 percent of natural gas, and 82 percent of coal is unburnable. But they also calculate these estimates for all the regions of the world with reserves. For the United States, they estimate that 6 percent of oil, 4 percent of natural gas, and 92 percent of coal is unburnable. (Importantly, these numbers change only slightly if carbon capture and sequestration is assumed to be widely deployed by 2025.)

Bottom line: even under the strictest scientific constraints with respect to global warming, the optimal (in the sense of social welfare) scenario for the U.S. energy system almost completely exploits existing our oil and natural gas reserves (and almost completely halts coal burning and further fossil fuel exploration).

Ok, that's a smart accounting exercise by researchers who modeled a world committed to saving the planet. But what if we consider the question from a completely different perspective? How would a high-functioning government in the U.S. use a natural gas option to pursue a carbon reduction goal under some meaningful conditions like keeping the lights on and the bills affordable? Forget scientific research. How about long-term planning in the real world? Again, fair enough.

In September 2014, a group of 25 companies, organizations, and foundations known as the Low-Carbon Grid Study (LCGS) released a report to determine a pathway for meeting California's ambitious goal of cutting in half its greenhouse gas emissions by 2050. The report used assumptions from the California Public Utilities Commission, the California Air Resources Board, and the California Energy Commission and is built on analysis by NREL, the National Renewable Energy Lab. That is an all-star team for any energy policy fan.

The analysis shows that meeting the goal is possible with minimal impact on electricity rates and no compromise in electric grid reliability. The keys to the transition are energy efficiency, renewable energy sources, energy storage, electric vehicles, regional cooperation in energy markets, and the strategic and efficient use of natural gas dispatched to provide energy to the grid. Even in California, where stars align to an extent that climate hawks in other states can only dream about, natural gas is a critical element of getting to 2050 when real plans are being made for a real energy system.

All of these long-term accounting and planning scenarios, even if we accept their assumptions and methods, skip past the feasibility of actually implementing the changes they describe. What good are these exercises if they don't take into consideration the difficulty of actually making the changes needed to realize them? One last time, fair enough.

A Jan/Feb 2015 study of this question is so on point that I'll just recite the title: "A critical review of global decarbonization scenarios: what do they tell us about feasibility?" The authors examine 17 scenarios from 11 studies. All these scenarios describe reductions of 50-90 percent in global CO2 emissions by 2030-2060. Every one of the scenarios assumes historically unprecedented rates of improvements in energy intensity (the amount of energy needed to produce a unit of economic output) and most assume improvements in carbon intensity (the amount of CO2 emissions needed to produce a unit of energy output) that would require staggering increases in installed capacity for renewables.

But the most important conclusion for our present purposes is this: "Finally, all of the studies present comparatively little detail on strategies to decarbonize the industrial and transportation sectors, and most give superficial treatment to relevant constraints on energy system transformations. To be reliable guides for policymaking, scenarios such as these need to be supplemented by more detailed analyses realistically addressing the key constraints on energy system transformation."

But I would extend this argument to say that "analyses" alone will not suffice in "realistically addressing the key constraints." Policy outcomes capable of achieving ambitious transformations require compromises as much as analyses. And compromises require the convening of stakeholders for a facilitated discussion of the concerns that will make or break the negotiations.

The Philadelphia energy hub is a complex example of this. What are the design choices that would go into a collective vision of a Philadelphia energy hub? Can we specify the major benefits and costs of the energy hub within the Philadelphia region (we could make a similar list for the Commonwealth, the Delaware River Watershed, the United States, the Earth, etc.) that would allow stakeholders to identify the conditions under which they could support an energy hub strategy? We have useful examples of these collaborative processes, including one centered on natural gas.

The Salem Harbor Power Station opened in 1952 and burned coal for sixty years to supply the Boston area with electricity. In 2010, the Conservation Law Foundation (CLF) won a lawsuit based on the Clean Air Act against Salem Harbor's owner, Dominion, and secured an order from the U.S. District court to approve a consent decree that would shut down coal operations by 2014 and prevent any future owner from ever burning coal on the site. In 2012, an energy company called Footprint bought Salem Harbor with a plan to convert it into a 630 megawatt, $800 million combined-cycle gas-fired turbine power station. But CLF went to court to stop the plan, arguing that natural gas is better than coal but still not good enough to meet Massachusetts's own carbon emissions goals set for 2050.

That's when things got interesting. CLF and Footprint negotiated a deal that aligned all the salient concerns: Massachusetts's carbon reduction targets, Footprint's stated business plan, and CLF's mission of environmental protection in accordance with state and federal laws. The basics of the deal are (1) the plant will open in 2016, (2) it must begin to reduce its CO2 emissions by 2026, and (3) its emissions must be one-quarter of its 2016 emissions by 2049. If Footprint can't meet these conditions with technology that reduces its emissions, then it must either reduce operations accordingly or purchase renewable offsets.

The deal makes the "bridge to the future" a real thing, writing the specifics of the agreement into Footprint's permit to operate, which was approved by the state in 2014. The agreement designates how much CO2 may be emitted over a specific period of time and delineates remedies if the emissions exceed the permissible levels at given points in the future.

According to the Boston Globe, in January 2015, Footprint secured financing for the $1 billion natural gas-fired plant. The prime contractor for the project, Iberdrola Energy Projects, received notice to proceed and started demolition and remediation work. The on-site workforce is expected to peak at 700 employees in the summer of 2016. The goal is to have the plant online in June 2017.

The quick-start combined-cycle gas turbine will have the ability to provide 674 MW of power to the grid with nearly half of that output available in 10 minutes and the remainder over the course of an hour. In the near term, as one of the most efficient units on the grid, Footprint anticipates the plant will operate most of the time. In coming years, the plant is expected to operate as a "firming" resource that is called upon when intermittent resources like wind and solar are unable to keep up with demand.

Admittedly, this is a simple and well-defined deal compared with the multiple competing concerns wrapped up in the Philadelphia energy hub. But it does illustrate the point and shows that it's at least possible to design compromises that create an acceptable balance among economic and environmental concerns in using natural gas to transform the energy system. That balance would weigh the expected benefits against expected costs and make provisions to ensure that those who actually feel those costs are fully compensated for them.

This last point is critical. For example, some environmental costs are not distributed evenly. Global warming will affect all of us. Delaware water quality will affect virtually all of us. Protections on such concerns can be largely uniform. But a Chester County landscape along a new pipeline route or air quality next to a new gas-fed industrial facility along the Lower Schuylkill are concentrated costs that need to be recognized in any compromise. Likewise, economic benefits are not distributed evenly. If jobs are part of the benefits being weighed in the balance, then who gets those jobs matters. Would the revenues generated by the economic activities of the hub be large enough to close the skills gap in the region's workforce to make these job opportunities meaningful for residents, and would those revenues be in fact spent on workforce preparation?

In the end, are Philadelphia and Pennsylvania up to the challenge of drafting a deal like Salem Harbor but on a much more complex issue? Can we identify the elements of such a deal and convene legitimate voices to explore the specific tradeoffs among those elements? Is there a compromise that a majority can embrace and that ensures protections for all?

These questions demand self-governance. There is no single trigger like a lawsuit before a U.S. District Court that will lead to a negotiation like that among CLF and Footprint and Massachusetts's energy and environmental regulators that produced the Salem Harbor agreement. A Philadelphia energy hub worth having will require a voluntary process among civic-minded parties capable of advancing all the important interests at stake.
Maybe no compromise exists. Maybe the benefits will be so small and narrow and/or the costs so large and widespread that civic-minded parties with skin in the game could never agree to an energy hub worth having here.
But the only way to find out is to convene those parties and facilitate that discussion. I believe it takes a political champion to convene the parties under a process that has enough legitimacy to get the right people in the room and willing to do the hard work. Once convened, however, facilitating the discussion among the parties is something that universities can help with, as trusted partners committed to open discussion and fair play.

The purpose of that facilitated discussion would be to to search for compromise among stakeholders using well-known methods. (Thanks to my Penn colleague, Elise Harrington, for bringing this particularly useful example to my attention.) These methods engage parties in a decision-oriented discussion that considers both facts (from scientists and other sources) and values.

Choosing among alternatives involves making tradeoffs among competing objectives and being exposed to those tradeoffs through discussion with other stakeholders. Stakeholders are charged with making choices in the public interest, based on their own perspective but also reflecting what they have learned in the deliberative process from experts and other stakeholders.

Nothing about the energy hub discussion to date sounds even remotely like the above. Boosters and doomers talking without listening have more in common with an Eagles game than with a facilitated process of structured decision-making. But that process may be the only way to make real progress toward a Philadelphia energy hub worth having. The Kleinman Center is actively working with stakeholders across the spectrum of energy hub interests to explore the possibilities.

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