The Philadelphia Energyshed

Mark Alan Hughes, University of Pennsylvania
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Significant aspects of energy generation, distribution, and consumption operate at a regional scale. These operations, which are a function of both technical and organizational realities, interact to form an "energyshed." The energyshed is an organizing idea that helps both to understand the connections between urban form and energy use and to engage regional stakeholders in optimizing energy.

Energy is the foundation for the broader sustainability agenda pursued by governments, businesses, and institutions in regions across the U.S. Energy efficiency (which means creating value by reducing waste) and renewable energy (which means creating value by reducing carbon) provide resources and rationales for related goals ranging from recycling to local food to public health to job creation.

STRATEGIC ENERGY MANAGEMENT is thus a key to this region's future as a prosperous place to live and work. Three inter-locking changes in energy policy are worth understanding as we work to define a regional energy strategy. We sketch recent changes in local, state, and federal policy.

FIRST, while national governments get all the attention at climate treaty negotiations in Kyoto and Copenhagen, local governments are critical to reducing emissions because that's where rhetoric meets reality. Both innovation and implementation happen on the ground where people actually live and work. Yet local and regional governments have little voice and no formal recognition in frameworks being developed to govern climate change strategies.

Local governments in the U.S. have committed to reducing emissions and are devising ways to meet those commitments through local initiatives. Seattle, Portland, San Francisco, New York, Chicago, and this year Philadelphia have successively pushed the envelope on what it means to be the "greenest city in America."

Philadelphia's 2015 targets include lowering government total energy consumption by 30% from 2008, lowering citywide building energy consumption by 10% from 2006, acquiring 20% of citywide electricity from alternative sources, and lowering citywide greenhouse gas emissions by 20% from 1990. Several of our County and suburban governments have made or are determining similar climate and energy goals and DVRPC has completed a carbon inventory for the nine-county region that provides a basis for setting regional goals.

SECOND, Pennsylvania, New Jersey, and Delaware have advanced several important pieces of game-changing legislation on energy. In Delaware, the statewide Sustainable Energy Utility has created a consolidated public authority to finance and manage a scalable investment in energy efficiency across all sectors of power consumption. In New Jersey, the CORE rebates and tradeable SRECs have combined with federal tax incentives to vault New Jersey to second place among all states in installed grid-

connected solar capacity. In Pennsylvania, the Alternative Energy Portfolio Standard requires electric companies to supply 18.5% of electricity using alternative energy resources by 2021. (In 2007, the amount was less than 6%.) The AEPS is creating a market in Pennsylvania for the generation and distribution of energy resources like wind, geothermal, and solar.

Another important piece of legislation in Pennsylvania is called Act 129, which requires the Commonwealth's electric companies to reduce the total consumption of electricity in their service territories by 1% by 2011 and 3% by 2013 and to reduce peak demand by 4.5%. To meet these goals, electric companies are allowed to spend up to 2% of the annual rate base on energy efficiency programs, passing that cost on to customers in exchange for the reduced consumption.

This is a particular form of what is called "decoupling", meaning that an electric company's revenues are decoupled from how much electricity it sells because it can in effect charge rates for both conservation and consumption. Philadelphia Gas Works has developed a similar program that would allow it to generate resources to reduce the consumption of natural gas as well.

Finally this change interacts with the expiration of electricity rate caps throughout Pennsylvania on December 31, 2010. After that, in this region, PECO becomes only the "default provider" of electricity and anyone can purchase electricity from a long list of generation companies that should be able to provide power at lower rates. Soon, we should all be in the wholesale electricity market.

And THIRD, in addition to local and state policies, there has been a sea change in federal policy. The Recovery, or stimulus, spending this summer has attached new expectations for energy efficiency to the infrastructure, transportation, and housing grants distributed out by formula to states and cities. Also, for the first time, local governments were given Energy Efficiency and Conservation Block Grants (the City will receive $14.1 million and the five counties of SE Pennsylvania will receive a total of $26 million.)

Now attention is turning from the *formula* to the *competitive* Recovery grants that will be awarded in the coming months. PECO and its partners submitted a $200 million proposal for a Smart Grid project, PIDC and its partners will submit a proposal to transform the Navy Yard into one of the nation's most important energy research centers, and Penn and its partners will submit a proposal to form a new center for sustainable communities.

The most innovative application moving ahead in this region, however, may well be the proposal being developed by the Metropolitan Caucus. Under the leadership of its dynamic director Laurie Actman, the Caucus has united the five Counties of SE Pennsylvania behind a set of significant projects to create jobs and save energy throughout the region.

These three interlocking policy changes—local innovation, state legislation, and federal funding—all demand more strategic management of energy than governments, businesses, and institutions have ever attempted. To be sure, a number of individual actors in this region from both the for-profit and non-profit sectors have pioneered strategic energy management over the past several years. Liberty Property Trust has developed one of the nation's largest portfolios of energy efficient commercial new construction, including the country's tallest LEED-certified building and the country's first speculative

LEED-Platinum commercial office space. Thomas Jefferson University is a national leader in distributed energy generation through cogeneration and other advanced technologies. The University of Pennsylvania consistently ranks highest among U.S. educational institutions on renewable energy and energy efficiency commitments and has developed a ground-breaking approach to using computer modeling to optimize energy efficiency investments. And Drexel University is working with Viridity to combine distributed generation and microgrid technology.

In many ways, the next great challenge is creating the organizational incentives and mechanisms to aggregate these individual efforts and involve the large majority of governments, businesses, and institutions that do not now manage their energy in a strategic way. There is a need for new organizational capacities to convene and coordinate the energy management of individuals to achieve both scale economies and maximum impact.

As noted above, much of that energy management needs to occur at the regional scale, for reasons that are both technical and organizational. We label this regional scale an "energyshed" and now briefly explore some of its features.

- One simple but significant feature of an energyshed is the service territories of the utilities that delivery energy to consumers. For example, PECO's service territory consists of essentially the five counties of SE Pennsylvania. That territory defines the operations of its conservation programs being funded by Act 129. The rules that govern energy use have a regional quality because we tend to administer things geographically in the U.S. A complicating factor in this administrative geography stems from the state-level regulation of public utilities and energy more generally. While many features of the Philadelphia energyshed might operate most efficiently at metropolitan level, that scale would implicate at least three distinct state regulatory regimes.

- A more technically complex feature of an energyshed relates to what is called "curtailment" and more generally load shaping. This refers to a complex bundle of controls and contracts designed to prevent too much demand being placed on the electric grid at one time, both to protect it from blackouts and to reduce costs. This is even more important with the mandate to reduce peak load under Act 129. While this integrated load management can theoretically be done at any scale, in practice it gets organized among large institutions that can control their demand in response to the peak load, which basically means being able to raise dozens or hundreds of thermostats on a few hours notice on a hot August day. That takes a set of technical and organizational controls that are difficult to enforce beyond a regional scale.

- A further level of complexity related to load shaping moves beyond conventional curtailment to the deployment of load itself as a more fully dispatchable resource. This relies on the use of modern computing and modeling capacities to make next-day forecasts of load in combination with modern storage technology to control peak load. For example, new models and control software can use the thermal storage capacity of buildings as well as off-peak production and storage of chilled water to so nimbly shift load that load itself becomes a control mechanism.

Across a whole portfolio of buildings, this technology creates a set distributed resources of generation, storage, and smart buildings that all combine to virtual generation to a regional grid.

- A fourth feature of an energyshed has to do with energy consumers aggregating their energy purchases in order to get better and more stable prices, in other words volume discounts. These purchases have to be delivered through distribution systems of pipelines or transmission wires and are based on needs determined to some extent by weather and seasonal conditions that again exist at a regional scale. These purchasing groups are most likely to be organized locally and then linked within a region.

- A further complexity on the pricing issue arises because of the structure of pricing within the PJM regional transmission organization (PJM is our part of the national grid and it controls the high-voltage transmission system and coordinates the movement of wholesale electricity in 13 states and DC.) The PECO service territory is a single pricing zone within PJM, which means that prices are constant within the zone for given user classes and times. This creates an interesting collection action problem/opportunity. Any initiatives that reduce net demand on the load-serving entities within an energyshed (whether by conservation, additional generating capacity, or load shaping) will lower the price within the PJM pricing zone. Thus, there is a "free-rider" benefit for any consumer in the zone, not just those who pay and enact the initiatives. This constant pricing zone creates a rationale to invest as an energyshed in buildings that would yield the highest return on reduced demand and prices. In practice, this would likely mean combing resources across the five counties of SE Pennsylvania to invest in bundled portfolios of buildings in the institutions, governments, and central business district of Philadelphia. All consumers in the region would benefit from the lower prices generated most efficiently by distributed generation and demand management in the central city.

- A final feature of an energyshed relates to the market area of businesses and nonprofits that work within the energyshed. For example, many Recovery programs as well as Act 129 spend money on weatherizing buildings to increase their energy efficiency. That work has to be financed by lenders, marketed to building owners, and done by trained workers. Again, all this happens only when specific companies do work in specific places, and a small to mid-sized contractors will likely operate within a specific region where they develop a reputation and their workers can commute.

- A related feature of an energyshed is its impact, both actual and potential, on commuting patterns and thereby on investment in transportation and housing development. This is large topic and we provide only a placeholder here to acknowledge its importance. Location-efficient mortgages, transit-oriented development, and green infrastructure to support water and air quality are all energy strategies that operate on the scale of the energyshed. Metropolitan settlement structure understood as an energyshed is an approach to investment and policy development that views the energy implications of buildings, transportation, and infrastructure as linked rather than separate. In a carbon-constrained economy that prices energy efficiency,

emissions reductions being calculated and accounted for within the energyshed could help finance transit investments and TOD.

These features—regulatory rules, load management, energy purchasing, energy efficiency investments, transportation and housing patterns—all happen at the scale of a regional energyshed. Yet, we have no existing apparatus dedicated to pursuing the common interest in the energyshed and capable of convening parties that could benefit from a regional energy strategy. Such a strategy would lower our vulnerability to rising energy prices and climate change, and indeed could transform that vulnerability into an asset that brands Philadelphia as a smart place to live and work.

THE PHILADELPHIA ENERGYSHED IS POSITIONED TO BECOME A POWERFUL ENGINE OF BOTH COMPETITIVE ADVANTAGE AND CLIMATE RESILIENCY.

This is the moment when Philadelphia can recover its place within the American and global economy. For over half a century the assets we inherited—a regional network of walkable places connected by transit and green infrastructure with a low energy profile—have been declining in value. Our assets could not compete in a world of cheap energy and the off-ramp economy it produced.

But now our assets are rising in value and we have state and federal governments committed to accelerating rather than undermining that trend. There is no better place to build a low-carbon economy than a region like Philadelphia. No longer a warehouse of great need, we are once again a storehouse of great value—value waiting to be unlocked by leadership.

The key question becomes one of effective and feasible organizational form. What organizational form do we need to capture some or all of the opportunities in the energyshed? What jurisdiction, over both powers and territory, is necessary? A public entity or a voluntary association of corporations and institutions? Administered by an energy utility or administered independently of an energy utility? A new public authority or a repurposed one? A general municipal authority or one designed to provide business improvements? Must the new organization have the capacity to finance its activities through grants and/or bonds, or only through the stream of fees and/or savings generated by energy purchases and management or collateralized by energy efficiencies? These and other factors do not represent a puzzle with a solution but rather a set of decisions to be made.

A PROPOSAL: ONE OF SEVERAL OPTIONS

The City of Philadelphia would form a Sustainability Authority under the Pennsylvania Municipal Authorities Act and invite the voluntary association of the four other counties of the Metropolitan Caucus, which is allowed under the Act. The City would similarly form a new 501(c)(3) support organization that could complement the functionality of the Authority with powers not granted under the Act, such has energy trading.

Such an Authority would provide an immediate advantage to Southeastern Pennsylvania's application to the DOE for competitive EECBG funding. Under the leadership of the Metropolitan Caucus, a series of strategic partners are working together: The Delaware Valley Regional Planning Commission, The Reinvestment Fund, AFC First Financial Corp., the Energy Coordinating Agency, the TC Chan Center of the University of Pennsylvania, and Ben Franklin Technology Partners. We use the context of the EECBG to illustrate the general advantages of a Sustainability Authority in a specific setting.

The new Authority would demonstrate the commitment of the region to permanent and transformative change in the region on energy efficiency and renewable energy. The Authority would create the

organizational capacity to accumulate expertise on the many financing and program elements developed in coming years as well as develop an institution rather than simply a program. Perhaps most importantly, the new Authority would manifest a genuine competitive advantage in the application process: the region's ability to get five large local jurisdictions to agree to form a new public authority to identify and exploit our energyshed. These jurisdictions have recognized and propose to collaborate on the basis of regional scale efficiencies in the design, delivery, and documentation of investments to improve building performance. The demonstration effect of this regional scaling is a critical next step in moving beyond the efforts of a few sophisticated local jurisdictions and toward the genuine transformation of markets that operate at a regional scale. The rich portfolio of building types and neighborhoods provided by a fully regional partnership creates analytic and programmatic leverage beyond that available to single jurisdiction programs.

Regional scale creates two kinds of advantage for the proposed program. First, the regional scale creates efficiencies that derive from volume. We can exploit the full reach of various channels to market the proposed financial instruments to the residential and commercial building sectors (e.g., the service territory of the electric distribution company and the area of dominant influence of media outlets.) This reach is necessary to achieve the kind of market transformation called for in the DOE funding opportunity. Second, the regional scale creates efficiencies that derive from diversity in a portfolio sense. We can array the investment options of an entire building sector and determine which have the highest return on investment, generating maximum internal savings that can create resources for further investment. This approach allows us to port the work done with private building portfolios (e.g., campuses of university and hospital buildings) to the region's portfolio of public sector buildings.

The TC Chan Center has modeled the energy performance and guides retrofit investment on 200 buildings on Penn's campus and monitors, and it optimizes the energy performance of several dozen large buildings on three continents. TC Chan offers a highly sophisticated simulation model of building performance that makes accurate predictions about the impact of retrofits on energy consumption. Using the TC Chan simulation models to predict the returns to retrofit investments, calibrated by years of performance on Penn's campus, governments in the region would optimize the investments supported by the revolving loan fund component of the application, maximizing the return on investment and using accelerated paybacks to extend retrofits throughout the region.

The Authority would connect the programmatic dots of a competitive EECBG of $50-75 million, the formula block grant programs throughout the region totaling $27 million, the $200 million Smart Grid Investment Program recently awarded to PECO, and the investments of Act 129 estimated to generate $80-85 million annually. The Authority could draw down QECBs, RFZBs, as well as new bonds under its own authority collaterialized by energy efficiency and sales to the forward capacity markets. The Authority would have sufficient resources to move beyond reporting of measurement and verification and come to house and share a deep capacity for aggregation, marketing, financing, and the trading of environmental attributes and ecosystems services that would benefit green infrastructure and all classes of energy users throughout the region.

Mark Alan Hughes Ph.D. is a Distinguished Senior Fellow at the Penn School of Design and the Tsinghua-Penn TC Chan Center for Building Simulation and Energy Studies. He is a Faculty Fellow of the Penn Institute for Urban Research, a Senior Fellow of the Wharton School's Institute for Global Environmental Leadership, and a Distinguished Scholar in Residence of the Robert A. Fox Leadership Program in the Penn School of Arts and Sciences. He served as the City of Philadelphia's first Director of Sustainability and Chief Policy Adviser to Mayor Michael Nutter. Email: mahughes@design.upenn.edu