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Energy and Greenhouse Gas Emissions in Allegheny County, PA, from 1900-2000: Implications for Local Mitigation Planning

■ *By Michael Blackhurst*

During the 20th century, the Pittsburgh region experienced dramatic change from rapid industrialization to a mid-century economic powerhouse, followed by socio-economic decline in the latter third of the century. These changes are important in understanding energy use and greenhouse gas emissions in Allegheny County over the 20th century, and these changes are also important to analyze the region’s prospects for the future in reducing greenhouse gas emissions. This article profiles recent estimates of Allegheny County’s energy and greenhouse gas footprint from 1900 to 2000 and explores potential drivers.

Between 1900 and 1970, Allegheny County’s population doubled, and economic output from manufacturing –value added–grew nearly four-fold (see Figure 1). After that, however, the region experienced dramatic socio-economic decline. Between 1970 and 2000, population declined by 30 percent, and manufacturing output at the end of the 20th century approached levels from the early 1900s.

Such dramatic change significantly affected the region’s energy use and respective greenhouse gas (GHG) emissions. The availability of and markets for various fuels changed, heavily influenced by enabling

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The State of Entrepreneurship in the Mon Valley

■ *By Sabina Deitrick and Christopher Briem*

The University Center for Social and Urban Research (UCSUR) and the Institute for Entrepreneurial Excellence (IEE) at the University of Pittsburgh have been collaborating on a project designed to spur greater entrepreneurship in the Mon Valley. The project, Advancing Entrepreneurship in the Mon Valley (AEMV), is funded by the Economic Development Administration, U.S. Department of Commerce. We report here on early findings and outcomes of the project, which continues through 2015.

Context

Over fifty years ago economist Ben Chinitz in his famous piece comparing Pittsburgh to New York, *Contrasts in Agglomeration*, identified the lack of entrepreneurial spirit in communities tied to the steel industry:

The entrepreneurial supply curve is ... a function of certain industries of the social structure which are heavily influenced by the character of the area’s historic specializations. The proposition I offer is this: An industry which is competitively organized ... has more entrepreneurs per

dollar of output than an industry which is organized along oligopolistic lines ... My feeling is that you do not breed as many entrepreneurs per capita in families allied with steel as you do in families allied (with other competitively organized industries).

The Monongahela Valley – Mon Valley – was synonymous with steel for most of its history. Heavy industrial production dominated these communities for most of a century. When the steel industry collapsed in the early 1980s, the Pittsburgh region lost over 125,000 manufacturing jobs in less than a decade, almost half in primary metals alone, with much of the loss concentrated over just a few years between 1981 and 1984. This job destruction accelerated an equally deleterious out-migration of population that impacted nearly all of the communities in the region, and particular those in the Mon Valley.

Over the past thirty years, these river communities continued to struggle with their economic recovery and faced slow employment growth, limited commercial

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The State of Entrepreneurship in the Mon Valley

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investment, ongoing population decline, and rising vacancies, disinvestments often hampering other regeneration efforts.

Nonetheless, substantial efforts to rebuild the communities of the Mon Valley have been ongoing, and include building cross municipal collaborations, community development infrastructure, and economic development partnerships across public, private and nonprofit sectors to foster revitalization and employment opportunities. In the end, the question remains: Is entrepreneurship a method of regeneration for Mon Valley communities and an effective tool in a region that sorely lacked a history or social tradition of entrepreneurship?

Project Findings

AEMV has spent the past year working with partners and efforts to conduct a series of focused trainings and workshops for potential, prospective and existing entrepreneurs

in the Mon Valley. AEMV also focuses on specific business needs through individualized consulting to help businesses grow and support development of their communities.

To date our baseline analysis has found:

- One indicator of small business ownership is self-employment income. In the Mon Valley, rates of self-employment income are much lower than national averages. In much of the Mon Valley, fewer than five percent of households have self-employment income, compared to 10.8 percent of households nationwide with self-employment income.
- The industries where small firms (<10 employees) are the most numerous include the finance and insurance sector, with nearly 50 percent of employees working in small firms, followed closely by real estate and rental and leasing, at 42.0 percent of employment in small firms. This would be typical of SMEs in smaller communities.
- On the other side, only 2.2 percent of employees in mining and educational

services are employed in small firms, followed by 4.8 percent in manufacturing and 5.8 percent in arts, entertainment and recreation.

- Overall, fourteen percent of workers in the Mon Valley work in firms with fewer than 10 employees.

The Mon Valley is part of the Pittsburgh region that has historically lagged in the rate of new business creation, or entrepreneurial activity in general. The trend continues today.

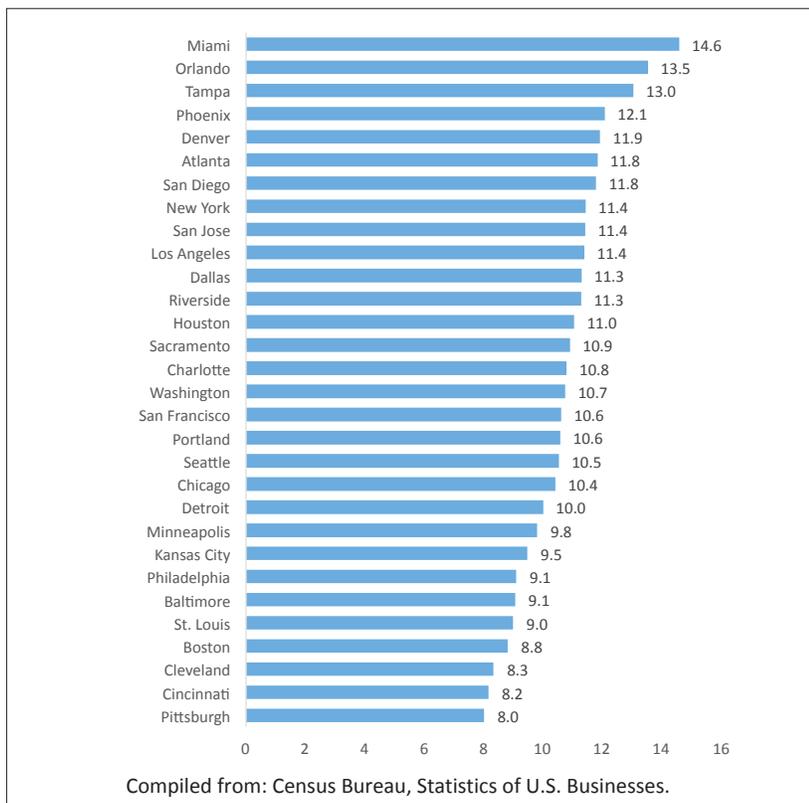
We examined data on new establishment births, available from the Census Bureau Statistics of U.S. Businesses (SUSB) datasets. An indicator of startup firms was developed – the ratio of new establishments to the number of existing establishments – and was benchmarked for the 30 largest metropolitan statistical areas, ranked by employment (see Figure 1). For the number of establishment births between 2010 and 2011 per 100 existing establishments, the Pittsburgh MSA ranks decidedly last.

That ranking is also consistent with another recently released index, the 2015 Kauffman Index of Startup Activity, where Pittsburgh was the lowest ranked metropolitan region in the study. For the second year in a row, the study rated Pittsburgh fortieth of the largest 40 metropolitan regions in startup activity. The index is based on the rate of new entrepreneurs, opportunity share of new entrepreneurs, and startup density, and the Pittsburgh region was at the bottom or next to the bottom on all three measures.

This dearth of new firm and establishment creation is possibly more severe within the Mon Valley itself, but highlights the challenging regional environment entrepreneurial efforts Southwestern Pennsylvania must address. Our work to date points to a divergence among communities and types of entrepreneurial activity. There exist communities that have little new business formation, but also clusters of communities with growing numbers of new investments and new businesses.

It's helpful here to focus on the work of Bill Aulet and Fiona Murray at the Massachusetts Institute of Technology (MIT), also done in conjunction with the Kauffman Foundation, who distinguish two overall forms of entrepreneurship through the difference of what they call "innovation-driven enterprises" (IDEs) and "small and medium enterprises" (SMEs).

Figure 1. Ratio of New Establishment Births (2010-2011) to Total Establishments (2011)
Firm Births per 100 Establishments, 30 Largest Metropolitan Statistical Areas



SMEs are vital to our communities and regional economies; IDEs drive regional and national economies. By example, Aulet and Murray are housed at the educational innovation powerhouse of MIT where innovation-driven entrepreneurship has produced tens of thousands of firms with millions of workers and revenues in the trillions over more than half a century.

While much work on entrepreneurship focuses on policies and programs to nurture IDEs, for areas such as the Mon Valley, however, entrepreneurship and the rebuilding of entrepreneurship is decidedly a set of efforts targeting SMEs. From family businesses and successful succession strategies to new enterprises finding attractive markets and locations, the emphasis on entrepreneurship in such areas focuses on the needs of more locally serving types of businesses, and these SMEs often benefit from programs aimed at endogenous development rather than exogenous strategies.

For these types of entrepreneurs in the Mon Valley, there has emerged a more robust development and support system, including enterprise zones, community development financial institutions, community development intermediaries, and small business development centers, such as located in the IEE. Though other regional service organizations are more focused on early stage, advanced technology enterprises, most—but not all—initiatives for Mon Valley entrepreneurs are directed to locally serving small business development.

As an example of coordinated development, the Steel Valley Enterprise Zone (SVEZ), started in the early 1990s, along with the Mon Valley Initiative, is developing a network of supporting organizations for the newest entrepreneurs and important support components of an entrepreneurial ecosystem. With involvement of other nonprofit organizations and public sector agencies, this partnership provides much needed financial support for SMEs.

SVEZ coordinates a multi-municipal agreement for redevelopment efforts across three communities. A set of interlocked projects and incentives, including involvement of Allegheny County Economic Development for property sales, has resulted in the branding of the Avenues of the Steel Valley, linking the commercial corridors that flow through Homestead, West Homestead and Munhall, into more integrated and identifiable

Table 1. Growth in Number of Mon Valley Firms, by Industry Sector, 2010–13

	Mon Valley	Pittsburgh MSA	U.S.
Agriculture, Forestry, Fishing and Hunting	34.2%	9.4%	1.9%
Mining, Quarrying, and Oil & Gas Extraction	52.2%	8.0%	6.0%
Utilities	2.8%	10.1%	2.3%
Construction	4.6%	-1.9%	-3.5%
Manufacturing	-5.4%	-2.4%	-2.6%
Wholesale Trade	-3.8%	-0.9%	1.2%
Retail Trade	-1.6%	-1.5%	-0.4%
Transportation and Warehousing	5.6%	6.6%	3.4%
Information	-28.8%	4.5%	0.1%
Finance and Insurance	-3.3%	-1.1%	-0.3%
Real Estate and Rental and Leasing	-0.1%	5.7%	2.9%
Professional, Scientific, and Technical Services	4.8%	-1.6%	2.1%
Management of Companies and Enterprises	2.3%	1.8%	4.0%
Administrative and Support and Waste Management and Remediation Services	9.7%	3.6%	3.0%
Educational Services	9.1%	10.8%	8.9%
Health Care and Social Assistance	4.3%	2.7%	3.8%
Arts, Entertainment, and Recreation	3.0%	2.0%	3.1%
Accommodation and Food Services	6.7%	0.9%	4.6%
Other Services (except Public Admin.)	5.0%	0.0%	1.2%

Excludes public administration and establishments not otherwise classified.

Sources: County Business Patterns, Pennsylvania Department of Labor and Industry

“Streets” for investments. While success is modest, new businesses have already located through the Avenues, demonstrating that the community and economic development work in this region will increasingly benefit from a network of collaborative, multi-municipal efforts, such as this.

Initially, we considered two potential “clusters” of new firms, and especially new IDEs, firms related to the Marcellus Shale gas industry and tourism. The Mon Valley is proximate to major drilling in the Marcellus Shale and provides recreational access to river-front resources and “rails to trails” development. To date, new firms in the mining sector expanded rapidly from a low base (see Table 1), but entrepreneurial activity related to this sector has not continued from its initial fast expansion. It’s possible that supply chains come well-established, and fewer new firms have successfully entered the market.

The impacts of tourism and recreation are also not clear, at this point. For tourism and recreation, firm growth has not surpassed U.S. averages; however, the completion of the trail is recent and its impact may not yet be reflected in some data. One sector that

has increased in number of firms between 2010 and 2013 is accommodations and food services, which certainly could in part be related to the tourism and recreation sector.

Beyond the preliminary findings that neither the energy nor tourism sectors have not expanded as robustly in new firm formation, our earliest results show that most of the new and prospective firms from our program and partners are SMEs, not IDEs. The Mon Valley location works well for certain types of start-up businesses, especially those engaged in support and services of the nascent entrepreneurial ecosystem developing in the Mon Valley.

This points to signs of promising redevelopment in a region ravaged by the forces of post-industrial restructuring, with devastating jobs and population losses over decades. In these post-recession years, an upturn in firm formation in the Mon Valley is a promising sign of revitalization in the region.

All programs and workshops of Advancing Entrepreneurship in the Mon Valley are available free of charge. For more information, visit www.monvalleyentrepreneur.pitt.edu or contact iee@innovation.pitt.edu, 412-624-3095.

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technologies and policies, and with that the types and amounts of fuels used for energy services also changed.

Much like Pittsburgh’s storied century of change, the region’s historical energy use and GHG emissions were influenced by both regional choices, as well as broader international and global changes exogenous to Allegheny County. Understanding the implications of the historical account is important for current greenhouse gas mitigation planning.

Average greenhouse gases emitted per average unit of energy consumed are shown for Allegheny County over the same period, 1900–2000 (see Figure 2, part a). For the first half of the 20th century, the carbon intensity remained relatively consistent at around 0.3 tonnes of CO₂e per MWh. Such consistency is due a relatively unchanging fuel mix (around 80 percent coal, 10 percent biomass, and 10 percent petroleum), providing energy services through direct, onsite combustion, such as the making of steel or heating buildings.

The steady reduction in emissions intensity observed after 1950 stems from a rapid shift to electric power, steady efficiency increases for both energy production and consumption, and less coal use for all energy services. In particular, natural gas and nuclear power increasingly replaced coal in the production of electricity power over the latter half of the 20th century.

Estimated greenhouse gas emissions per capita show surprisingly little variation over the century, given the degree of broader change experienced by the county (see Figure 2, part b). The minimum, maximum, and average estimates are 13.5, 21.1, and 17.4 tonnes of CO₂e per capita, respectively. Even more surprising are the similar estimates for 1900 and 2000 at 18 and 17.6 tonnes per capita, respectively.

Finally, total estimated greenhouse gas emissions from fossil fuel consumption in Allegheny County from 1900 -2000 is shown in Figure 2, part c. From 1900-1970, emissions rose steadily, driven mostly by increasing population and economic output. Emissions growth ebbed between 1940 and 1970 as a result of aggressive shifts away from coal consumption and changes in supply and demand technologies. Following 1970, total emissions decreased significantly, from a peak of around 34 million tonnes in 1970 to around 23 million tons by 2000, or an average annual decrease of about 1 percent.

Over the 20th century, major shifts occurred in the types of energy services powering Allegheny County. In 1900, nearly 60 percent of the county’s energy use supported industry and only 10 percent of energy use supported transportation. By 2000, these shares were both around 30 percent. Mid-century, the emissions in the residential and transportation sectors grew significantly. After 1970, emissions from the residential and transportation sectors remained relatively constant despite significant reductions in population and employment.

The factors influencing local energy consumption and greenhouse gas emissions are many and varied, from individual decisions made by local households to broader technical innovation and international global fossil fuel commodity markets.

A timeline shows select major drivers for Allegheny County energy use and greenhouse gas footprint over the 20th century. While far from comprehensive, Figure 3 highlights the importance of considering drivers exogenous to Allegheny County in influencing local energy consumption and emissions.

For example, broader technical and business innovation in delivering electric power to consumers - fostered by many local, state, and federal policies - significantly expanded the geographic scope of electricity markets. In particular, the development of long distance transmission lines connected remote power sources to consumers, allowing for economies of scale in generation that delivered affordable electric power. In combination with post-war consumption of appliances and household devices, electricity consumption in the residential sector increased significantly. Similar exogenous influences are demonstrated by the federal promulgation of minimum efficiency standards for household products and vehicles, above code technology choices like *EnergyStar* products, the development and adoption of affordable personal vehicles, and technical innovation in renewable energy.

Of course, the Pittsburgh region often influenced these broader events. Westinghouse, a global leader in technology innovation in the electric power industry, was founded in Pittsburgh in 1886 and was headquartered

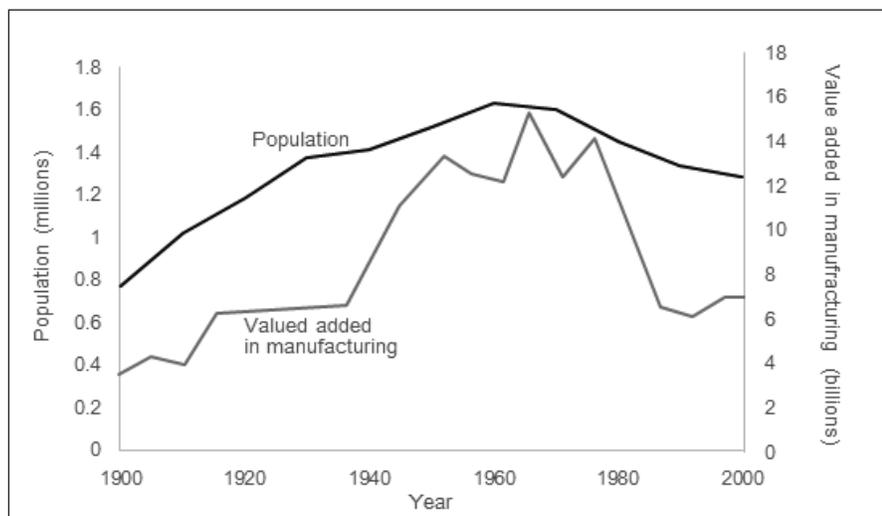


Figure 1: Estimated population and value added in manufacturing for Allegheny County, PA from 1900-2000. Population data from U.S. Census of Population and Households (various benchmark years). Value added data from U.S. Census of Manufacturers (various benchmark years) and the Industrial Databook for the Pittsburgh District (1936) published by the University of Pittsburgh, Bureau of Business Research.

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for Allegheny County between 1970 and 2000, albeit a reduction that followed 30 percent and 50 percent reductions in population and manufacturing output, respectively. These anecdotes suggest the scale of change needed to achieve the City’s reduction goals.

While such reductions may seem daunting, the Pittsburgh region has a strong history of leadership in energy and the environment. A combination of regional and technical innovation and local, state, and national policy shaped the county’s historical emissions. A similar combination is likely to influence emissions moving forward. This means that local planning efforts should involve forecasting of exogenous drivers, such as the proposed U.S. Environmental Protection Agency’s Clean Power Plan rule and expected changes to climate. It also suggests that the region has an opportunity to leverage its strength in innovation and manufacturing to produce tomorrow’s energy technologies that can serve both local and broader markets.

Primer on Greenhouse Gas Emissions from Energy Use

Greenhouse gases are so called due to their “greenhouse effect,” which refers to their tendency to trap heat when released into the atmosphere. A majority (83 percent) of U.S. greenhouse gases are released as carbon dioxide (CO₂) when fossil fuels are burned. Other greenhouse gases are associated with fugitive methane emissions (10 percent), industrial process emissions nitrous oxide (5 percent), and fluorinated gases (2 percent).

When fossil fuels are burned, they release energy and a variety of emissions. The emissions factor describes the emissions released for a given amount of energy produced, which varies by energy source. Burning 1 metric tonne of coal (around 2,200 lbs) releases around of 2.6 tonnes of greenhouse gas emissions and produces around 26 gigajoules of energy.

The same amount of energy derived from burning natural gas releases about half of the emissions, or 1.3 tonnes. For reference, a typical home in Allegheny County consumes approximately 100 gigajoules of energy per year.

Some energy services use fossil fuels directly, such as driving a gasoline-powered vehicle or heating your home with natural gas. Primary energy is the energy content powering these services.

Energy source	Emissions released per unit of energy produced (kg of CO ₂ emissions per gigajoule)
Coal (anthracite)	99
Coal (bituminous)	89
Gasoline	67
Natural gas	50
Nuclear and renewable energy	0

On the other hand, a majority of electricity is generated remotely, then delivered to buildings. Energy that is converted – such as electricity – is often called final, delivered, or site energy.

A variety of energy sources are used to produce electricity, including coal, natural gas, nuclear power, and renewables. When generators release electricity to the power grid, the energy sources used to produce electricity are no longer distinguishable.

Thus greenhouse gas emissions from electricity consumption are typically averaged across all types of primary energy sources. Emissions from electricity are also typically reported for delivered or site consumption (the amount on your bill), which accounts for any energy losses associated with inefficiencies in combustion, distribution, and transmission.

Thus burning natural gas directly to heat your water at home is more efficient than burning natural gas to create electricity that is then used to heat water.

New Staff at UCSUR

The Urban and Regional Analysis Program at UCSUR welcomed two new staff members this spring, and we are pleased to announce that Elizabeth Monk and Michael Blackhurst will be working on projects at UCSUR:

Dr. Michael Blackhurst recently joined UCSUR as a Research Development Manager. Dr. Blackhurst received both his undergraduate and graduate degrees in engineering from Carnegie Mellon University. Before joining UCSUR, Dr. Blackhurst was an Assistant Professor at The University of Texas at Austin, where he taught courses in sustainability, environmental life cycle assessment, and engineering economics. Prior to that, he provided water resource management, land development, and infrastructure systems planning consultant services for public sector clients nationwide. His research is robustly interdisciplinary, drawing especially from engineering, economics, and statistics. Dr. Blackhurst has supervised applied and basic research projects in the education, energy, and environmental sectors, and his work has been profiled in the New York Times and National Geographic. At UCSUR, Mike is supporting the development of the Regional Data Center, the Southwestern Pennsylvania Community Profiles website, and the Annie E. Casey/

Urban Institute funded project on chronic absenteeism in public schools. Mike is happy to be back in Pittsburgh, cheering on the Penguins and eating french fries on salads! Mike can be reached at: mfb30@pitt.edu.

Liz Monk recently graduated from Pitt’s Department of Geology and Planetary Science with a Professional Science Master’s degree in Geographic Information Systems (GIS) and Remote Sensing (RS). She received her BA from Penn State University where she designed her own major studying environmental ethics. She has previously worked as a GIS analyst at Purple Land Management and interned at Fracktracker Alliance. Liz also served as an environmental volunteer for the United States Peace Corps in Romania. At UCSUR, she is managing the Southwestern Pennsylvania Community Profiles website, funded by Allegheny Department of Human Services (DHS) through its Human Services Integration Fund, and assisted in the Sixth Annual Data Users’ conference earlier this month. Liz is also involved in the Data Use and Evaluation Pilot project, funded by the Pittsburgh Foundation. Please contact Liz Monk at: monk.e@pitt.edu.

Data Users Day at UCSUR—Launching Southwestern Pennsylvania Community Profiles Website

■ By Sabina Deitrick

On June 5, 2015, the Urban and Regional Analysis Program (URA) at UCSUR held its Annual Data Users' Conference at the University Club on the Pitt campus.

This year marks the sixth year UCSUR has convened the data conference, bringing together users of neighborhood information and providers of data sources for an afternoon to discuss applications, compare analyses, and learn about new developments in data applications and development.

This year also marks the launch of a new website and information source—the Southwestern Pennsylvania Community Profiles (see PEQ December 2014).

The event began with Doni Crawford, Community Data and Policy Fellow at Neighborhood Allies. Neighborhood Allies is a community development organization, re-launched in 2014, and the local Southwestern Pennsylvania affiliate of the Local Initiatives Support Corporation (LISC). Both Neighborhood Allies and LISC have been supporters of or involved in UCSUR data user conferences in the past.

Doni presented the results of a Neighborhood Allies survey designed to understand and assess the use of neighborhood data, resources, and technical assistance, conducted in late 2014–early 2015. Eighty-one neighborhood organizations completed the survey, with half either a community development corporation or community-based organization. The remainder were social service or other nonprofit organizations.

Community information was widely used by organizations across a range of purposes, but, for most of these organizations, they've only been engaged in using community information for less than a year. Despite that, most

organizations rated their capacity and ability to use community information from moderate to high.

Survey respondents reported having the highest levels of expertise with the following data tools: spreadsheets, databases, qualitative data collection, and online survey tools. GIS (geographic information systems) and statistical analysis were the tools they rated as having the lowest levels of expertise in using.

And despite level of expertise with various tools, over one third of survey respondents reported that "lack of time" was the single most common constraint for the organization to use data effectively.

The results of the Neighborhood Allies survey are being incorporated into the new Southwestern Pennsylvania Community Profiles outreach and training plans. UCSUR will meet with and train these community data users on the many applications available from the site.

UCSUR staff member Bob Gradeck then presented an overview of neighborhood indicators and how community organizations use indicators in their programs and operations. The session marked the transition at UCSUR from the data tool, the Pittsburgh Neighborhood and Community Information System (PNCIS), developed ten years ago, to more advanced data tools and projects, Southwestern Pennsylvania Community Profiles and UCSUR's Regional Data Center, an open data hub currently under construction.

Liz Monk formally kicked off the Southwestern Pennsylvania Community Profiles site at the conference to the data users (<https://profiles.ucsur.pitt.edu>). The site is largely completed across eleven domains: Arts & Culture; Civic Vitality &



Doni Crawford of Neighborhood Allies



Liz Monk presents SW PA Community Profiles

Governance; Demographics, Economy; Education; Environment; Health; Housing and Properties; Human Services; Public Safety and Transportation. Each houses a variety of indicators discussed in the session.

Finally, users had a chance to play "Guess the Indicator," presented in a set of six maps of different community information. Janine Jelks-Seale of the Highland Park Community Council was the winner, the only person to get all six indicators correct.

The latter half of the afternoon was turned over to group discussions of the SW PA Community Profiles domains and data use. Conference attendees met at roundtables to discuss domain indicators and make suggestions for additional information to be added to the site. Users provided UCSUR with many valuable suggestions and additions.

For those interested in learning more about Southwestern Pennsylvania Community Profiles or to set up trainings, please contact Liz Monk at: monk.e@pitt.edu.

For those interested in the open data platform at the Regional Data Center, please contact Bob Gradeck at: rmg44@pitt.edu.



Data Users Conference session



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