A Model for Public-Private-Academic Partnership: Supporting Climate Planning Imperatives in Cities

Courtney Crosson [1]

[1]University of Arizona, Tucson, Arizona

ABSTRACT: As cities are pushed to the forefront of global climate leadership, long-range urban design and planning are increasingly urgent, yet municipalities face resource constraints. This paper provides a replicable model for academia to join with practice and local governments to fill this resource gap. This paper examines the case of a public-private-academic partnership (PPAP) formed between GLHN Architects & Engineers; the staff of the City of Tucson, Arizona; and the University of Arizona (UA). Led through an UA upper-level interdisciplinary design studio, the partnership used spatial mapping, quantitative analysis, and design inquiry to create a plan to achieve year 2050 carbon and water neutrality targets without sacrificing either livability or projected growth in downtown Tucson, Arizona. The case study demonstrates that the PPAP model can (1) marshal the necessary resources and expertise toward climate planning when small and medium size cities face resource constraints and (2) prepare the next generation of urban planners and designers with the analytical and design skills to leverage local expertise for climate planning, action, and monitoring. The Tucson model has secured multiyear investment from private and public partners as a result of the phase one work and has won awards for education (Arizona Forward's State Educator Award), design (Arizona AIA State Design Award for Regional and Urban Planning), and leadership (ACSA/AIA National Practice and Leadership Award).

KEYWORDS: Public-Private Partnership, EcoDistrict, Future Cities, Net Zero Energy, Net Zero Water

INTRODUCTION

> We see the withdrawal from the Paris Climate Accord as an abdication of American Leadership and America's mayors will certainly fill that void... This is a local issue that mayors must come together on and we will not shirk our responsibility. : Gregory Stanton, Mayor of Phoenix, Arizona and Chair of the US Conference of Mayors' Environmental Committee, in 2017 upon the announcement that the US pulls out of its commitment to the Paris Climate Accord

In 2017, when the US announced it would pull out of the Paris Climate Accord, over 1,040 US mayors had signed the United States Conference of Mayors' Climate Protection Agreement to reduce greenhouse gas emissions below 1990 levels, in line with the Kyoto Protocol (Rosenzweig 2010, Mayors Climate Protection Center 2017). Urban leadership is critical to advancing the global effort to mitigate climate change. According to the International Energy Agency (IEA), urban areas are responsible for 71% of global energy related carbon emissions and this percentage will grow as urbanization trends continue (Rosenzweig 2010). However, despite the importance of cities in climate change amelioration and the stated commitments by US mayors, studies of urban climate action have found a consistent lack of "financial resources, technical capacity, and staff to develop and implement local climate change policies (Betsill 2010, Bulkeley 2005)." Large cities like Charlotte, Philadelphia, or San Diego have employees and budgets to focus on long term goals for decreased global warming impact. Small and medium size cities, like Tucson and Tulsa, face limited resources to match their aspirational pledge. Small and medium sized cities comprise over 95% of the signatories of the US Conference of Mayors' Climate Protection Agreement. How can expanding, small and medium size city signatories marshal the resources to create, enact, and monitor climate action plans that are uniquely tailored to their physical, social, and economic growth realities? How can academia help fill the resource gap to support climate action within small and medium cities?

In 2017, a public-private-academic partnership (PPAP) was formed to support climate planning, action, and monitoring in Tucson, Arizona, a fast-growing, medium sized desert city near the US border with Mexico. The partnership aimed to address the city's climate commitment to the Kyoto Protocol and Paris Accord by achieving year 2050 carbon and water neutrality targets without sacrificing either livability or projected growth in the downtown. The year-long collaborative project was led by one professor and ten students, sponsored by a local engineering firm, and supported by city and county staffs. Case study research, spatial mapping, quantitative analysis, and design inquiry were used to create three components to address Tucson's climate commitment: (1) district energy, water, and living infrastructure, (2) district land use plan with sustainable building prototypes, and (3) three sub-district master plans with rendered visions.

The broad-based 2050 plan was disseminated through an electronic and printed 240 page book. This partnership produced a pathway and vision incorporated into Tucson's recently ratified Pima County Board of Supervisors' Climate Change Resolution 2017-39 & 2017-51. The Tucson 2050 Plan has secured multiyear investment from private and public partners as a result of the work and has won awards for education (Arizona Forward's State Educator Award), design (Arizona AIA State Design Award for Regional and Urban Planning), and leadership (ACSA/AIA National Practice and Leadership Award).

This paper addresses the question of how academia can help solve the resource gap for climate action planning in small and medium size cities through the case study of the Tucson 2050 Plan and the public-private-academic partnership (PPAP) model. The paper starts with a review of research on the challenges faced by small and medium cities during implementation of climate commitments. Then, the PPAP model is defined within the case study of the Tucson 2050 Plan. Next, the opportunities, challenges, and impact of the PPAP model on (1) municipalities, (2) architectural pedagogy, and (3) architectural practice is discussed. The paper argues that the PPAP model can be successfully used to teach students the tools of climate planning and provide small and medium sized cities with actionable plans to bridge from pledges to tangible implementation.

1.0 CLIMATE LEADERSHIP IN CITIES: EMPOWERED YET RESOURCE LIMITED

> That's what everyone wants to know: Cities have limited resources, so how do you do this?
> :Sandra Ruckstuhl, Sustainable development Solutions Network upon announcement of the United Nations Sustainable Development Goals in 2016

Since the signing of the Kyoto Protocol in 1997, a diverse and deep literature within academia and practice has investigated how climate action can be successfully planned and governed (Betsill 2010). Over the last twenty years, two structures of multi-level governance for climate action have been the focus of these literatures: (1) tiers of multi-level governance, typically differentiating between administrative units (e.g. cities, states, and nations) and (2) networks of multi-level governance formed between actors (e.g. city governments, non-governmental organizations, and private companies) (Liesbet 2003, Meadowcroft 2007). This paper focuses on the later dynamic within the context of small and medium cities.

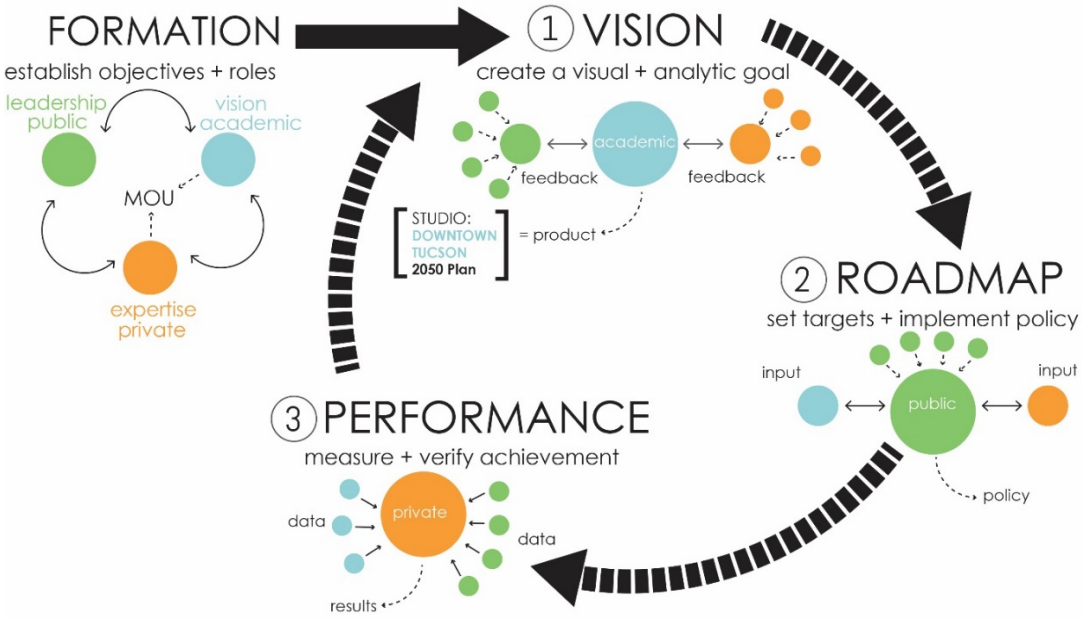


Figure 1: Public-Private-Academic Partnership (PPAP) model. Source: (Author 2017)

A reoccurring finding in the literature on climate action governance is the crucial need to link scientific research and policy practice, particularly in facilitating local climate action (Bulkeley 2013, Betsill 2007, Bulkeley 2005). A lack of resources, particularly in medium and small cities that have ambitions to contribute to climate change mitigation, has been consistently found (Bulkeley 2013). Michele Betsill and Harriett Bulkeley posit that an opportunity exists for academia to help solve the persistent local resource gaps in technical capacity for the development, implementation, and monitoring of local climate action (Betsill 2007). There is a need for private

and academic actors to participate in climate policy formulation, implementation, and monitoring if meaningful, long term change is to occur (Bulkeley 2005). This paper presents a model and case study to fill this need, particularly in an architectural pedagogical context.

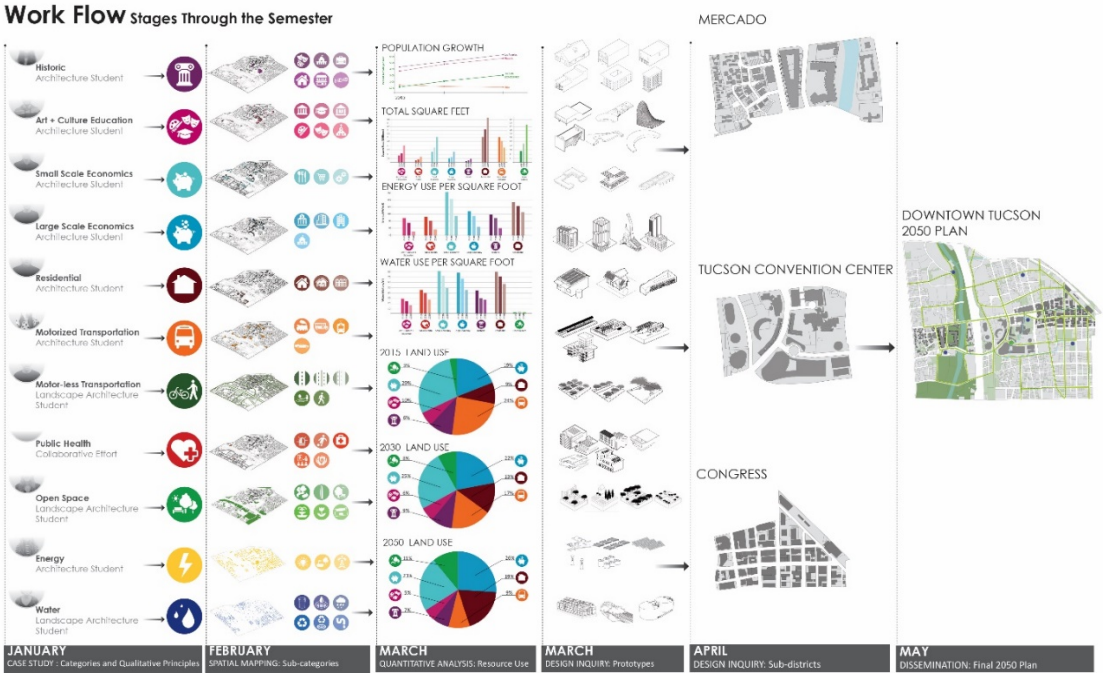


Figure 2: Work stages through the Spring 2017 semester. Source: (Author and Jennifer Braun 2017)

2.0 PUBLIC-PRIVATE-ACADEMIC PARTNERSHIP (PPAP MODEL: LEVERAGING RESOURCES TOWARD A SHARED FUTURE

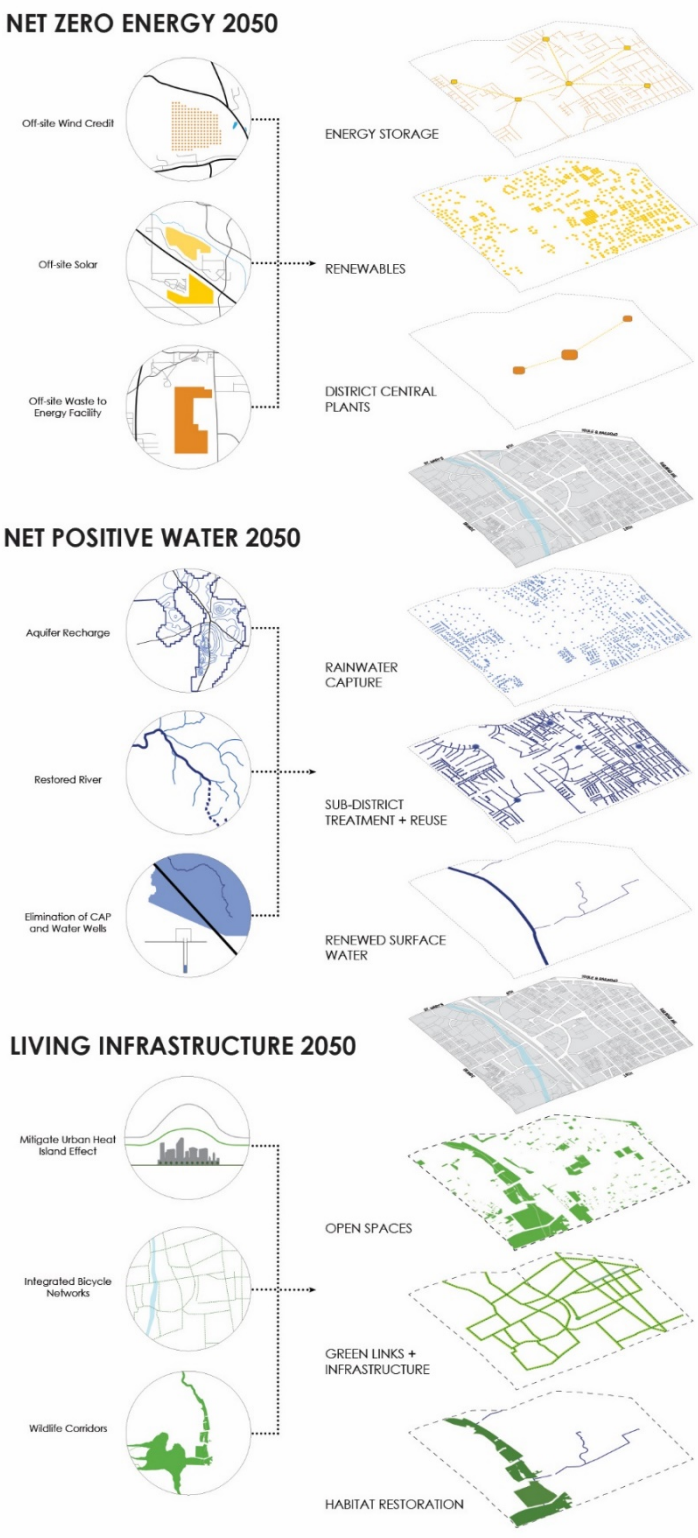
> Academic research potentially plays an important role in facilitating local climate action given the findings that local governments often lack the financial resources, technical capacity, and staff to develop and implement local climate change policies. :Betsill, Michele, and Harriet Bulkeley. "Looking back and thinking ahead: a decade of cities and climate change research." Local environment 12.5 (2007): 447-456.

Public-Private-Academic Partnerships (PPAP) has been broadly proven as a model to support climate planning within several collaboration-based organizations throughout the world. In Europe, the Urban Living Lab (ULL) is a framework for collective urban governance and experimentation to address the sustainability challenges created by urbanization (Voytenko 2016). Similar in purpose and title, the Urban Transition Labs (UTL) currently operates in two European cities as co-creative collaborations between actors and researchers to address sustainable development in cities (Nevens 2013). Within the United States, Metro Lab is a framework under which over two dozen city governments have joining with university partners to focus on the research, development, and deployment of new technologies and approaches to urban challenges (MetroLab 2017). This paper outlines the PPAP model used in the case study of the Tucson 2050 Plan between a state university, architecture and engineering practice, and local government.

To leverage the resources and responsibilities of public, private, and academic entities, the Tucson 2050 Plan codified a model for the long term collaboration (see Figure 1). The replicable PPAP model consists of three phases, each led by the expertise of a different primary partner: (1) vision creation / academic partner, (2) policy roadmap / public partner, and (3) performance verification / private partner. This paper focuses on the case study execution of phase one, vision creation (see Figure 1).

3.0 METHOD: THE CASE OF THE TUCSON 2050 PLAN

The Tucson 2050 Plan was led by one architecture professor at the University of Arizona, sponsored by the local engineering firm of GLHN Architects and Engineers, and supported by City of Tucson and Pima County staff. Phase one occurred over the course of a year, roughly divided into thirds. The project's goals were two-fold: (1) support local City of Tucson and Pima County commitments to climate planning, action, and



monitoring through the PPAP model and (2) equip the next generation of urban designers with a skillset able to address the pressing challenges of their urban environment. To achieve these goals, a framework for the partnership was established through a memorandum of understanding (MOU) with the three entities in the first third of the year. Then, students were taught the methodologies and tools of spatial mapping, quantitative analysis, and design inquiry during a spring semester design studio in the second third. And finally, in the final third of the year, the work was further developed by a paid student intern and disseminated by all three entities to gain wider community buy-in.

3.1 Partnership Planning and Codification: the first third

The first third of the yearlong project planned the course and deliverables and clarified of the roles between the private, public, and academic entities.

1. MOU Formalization: A MOU was signed between partners and established a project budget, roles and responsibilities, and timeline for deliverables. The private partner, GLHN, contributed funding to support the dissemination of the work and the hiring of a research assistant during the summer after the studio offering to support these efforts. City and county staffs, though not officially involved in the MOU, contributed time in all stages for planning meetings, work with students, leading student field trips, formal reviews of student work, arranging and participating in forums for dissemination of work, and letters of support.

3.2. Research and Work Production: the second third

The second third encompassed the majority of the research and work production undertaken by the Tucson 2050 Plan. The effort was orchestrated through an upper level UA multidiscipline studio comprised of ten students (seven Bachelor of Architecture (B. Arch) students and three Master of Landscape Architecture (MLA) students) during the Spring 2017 semester.

Figure 3: Energy, Water and Living Infrastructure overlay for the Downtown Tucson 2050 Plan. Source: (Author

3.2.1. Case Study Research and Qualitative Goal Setting: January

2. Case Study of High Performing Sustainable Cities: Students researched ten cities that had been nationally or internationally identified through public sector awards as a set of best practices for planning for carbon and water neutrality.

3. Case Study Interview and Site Investigation: Austin, Texas was identified as the case study city most closely aligned with Tucson. Students traveled to Austin and interviewed public and private officials on their sustainability plans for the fast-growing city. Students then returned to Tucson and similarly interviewed public and private actors to understand the current attitudes and previous plans. Interviews included the following actors: County Sustainability and Conservation Department, City Planning and Development Services, City Transportation Department, City Energy Manager, City Waste Recovery Manager, Tucson Water, City Historic Preservation Department, and City Archaeologist.
4. Qualitative Goal Setting: Based on the research of case studies and Tucson, students set six livability principles for their future designs: (1) Self-sustaining, (2) Adaptability, (3) Health + Prosperity, (4) Density + Walkability, (5) Community Cohesion, and (6) Connection to Place.

3.2.2. Spatial Mapping: February

5. Category and Sub-Category Codification: Students divided downtown land use into eleven categories and forty-eight subcategories (see Figure 2). Using Geographical Information System (GIS), students created a database of all square footage in downtown and then categorized this current square footage into all forty-eight subcategories.
6. Mapping: Students mapped this divided square footage over the entire downtown. Students researched historic land use and change in land use in the eleven categories from 1775 to 2015.

3.2.3. Quantitative Analysis and Quantitative Goal Setting: March

7. Growth Projection: University planning faculty expert, Arthur Christopher Nelson, was engaged to devise appropriate land use growth projections – determined at 2% (2015-2030) and 3% (2030-2050). With these growth projections, students then allocated appropriate subcategory land use growth for 2030 and 2050, with added growth in categories, such as housing, that currently had a deficit.
8. Resource Demand Projections: Students employed national projected energy (kWh/sf), water (gal/sf), and waste (lb/sf) use intensities for 2030 and 2050 by subcategory to calculate downtown resource demands in the future.
9. Resource Supply Projections: Students used data from local weather stations and climate change projections to calculate potential energy supply through photovoltaics and water supply from rainwater in 2030 and 2050 for the purposes of achieving net zero energy and water by 2050.
10. Quantitative Goal Setting: Based on their quantitative analysis of current and future resources, students set three resource goals for their designs: net zero energy, water, and waste by 2050 with interim 2030 targets.

3.2.4. Design Inquiry: March and April

11. Prototype Design: Students designed building and landscape prototypes as the building blocks of the future 2050 downtown. Each prototype was tagged with the energy, water, and waste projections and cross-cutting design strategies that addressed the set qualitative and quantitative goals.
12. Infrastructure Design: Students envisioned a new set of energy, water, and living infrastructure to achieve net zero, quantitative goals while supporting the six livability, qualitative goals. Ultimately, this infrastructure used an increasingly decentralized network model.
13. Subdistrict Design: Students deployed the prototype designs and integrating infrastructure to further develop details and renderings of three subdistricts within downtown Tucson as test cases for the plan. Large rendering visualizations were one of the products emphasized as a key deliverable by the public and private partners.

3.3. Development and Dissemination: the final third

The last third was completed in the summer of 2017 with a student intern hired through the private partner's sponsorship.

14. Book Finalization and Dissemination: The book, 2050 Downtown Tucson EcoDistrict, was finalized at the end of the course. Students were required to use a uniform InDesign template throughout the semester to submit their work. Two student editors put the book together. The 240 page book was disseminated in physical copy (over 20 copies) and electronic form (since May 2017 the book has been read online over 335 times on Issuu)[1] to wider public, practice, and academic communities.
15. Community Engagement and Presentation for Next Steps: A student intern was hired jointly by GLHN and UA CAPLA to check the calculations and prepare presentation materials. Presentations were made by the PPAP team at local venues (two city and county staff brown bags) and annual international conferences (the Association for Environmental Studies and Sciences (AESS) and the International District Energy Association (IDEA)). Presentation of the material was also made at state and national awards ceremonies (Arizona Forward's Awards Gala, American Institute of Architects (AIA) Arizona Design Awards, and Association for Collegiate Schools of Architecture (ACSA) Conference).

Additionally, the Tucson 2050 Plan work was presented at the 2017 hearings of the Pima County Board of Supervisors' for the ratification of the Climate Change Resolution 2017-39 & 2017-51. Partners in private practice have secured funding for a multi-year investment to offer this studio each year. The next iteration of the PPAP studio is currently being offered during the Spring 2018 semester.

4.0 DISCUSSION: APPLICATION AND RELEVANCE

The goals of the Tucson 2050 Plan were two-fold: (1) support local City of Tucson and Pima County commitments to climate planning, action, and monitoring through the PPAP model and (2) equip the next generation of urban designers with the analytical and design skills to address the pressing challenges of climate change in their future public and private professional roles. This section discusses the success to which these goals were achieved for each partner and where opportunities exist for future improvements. Additionally, contributions to the literature on climate planning and multi-governance structures are outlined.

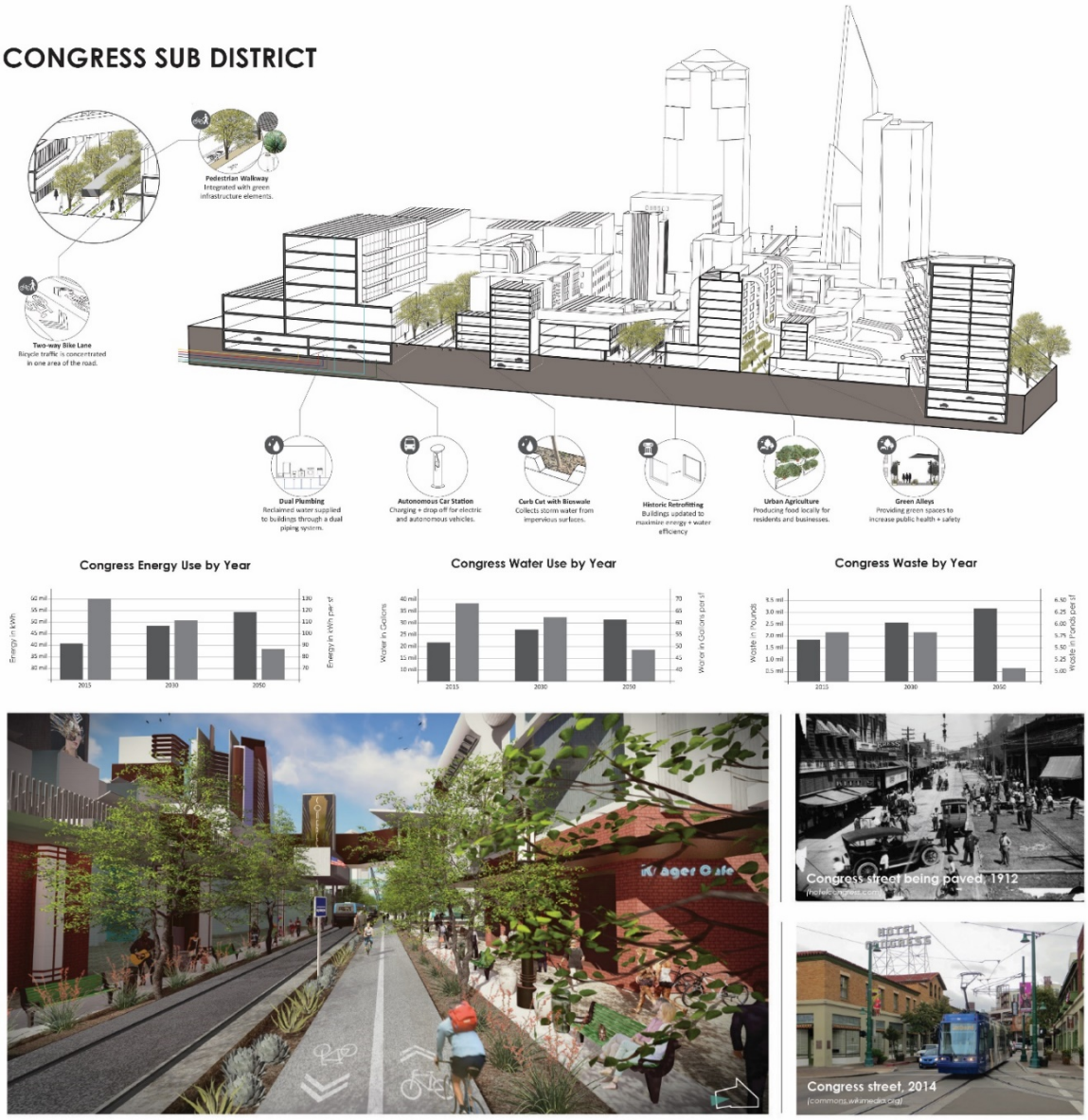


Figure 4: Section and rendering of Congress Sub-District. Source: (Author and Mikayla Krager and Brady Stanton 2017)

4.1 Public Partner: Assessing the PPAP Model for Climate Action Planning

> This collaborative project partnered with academia, private practice, and public government to create a quality product that addressed a critical gap within the city: a long-term, actionable vision for downtown Tucson. In its innovative and ambitious proposition, significant contributions were made… to reach higher sustainability standards and answer the city's call to climate action. : Jason Laros, Energy Manager, City of Tucson, June 2017

The PPAP model successfully leveraged the skills and resources from academia and practice to begin to fill the long term climate planning gap in the Tucson case. Sustainable solutions to climate change require deep

buy-in and a broad-base of support throughout a community (Meadowcroft 2007). The PPAP model was able to engage three different sectors of the community to help to lay a broader, foundational support needed by the public sector when enacting climate planning policy. The work was used to support the passage of the County Climate Accord Resolution #20017-39 and 51 the summer following the studio course (Pima County Board of Supervisors 2017). Through partnership of architecture and engineering practice with academic researchers and students, the city and county staffs gained a wider base of support and 'community capital' for climate action policy to be enacted. The challenge of gaining this support continues and is one of the major foci of the next two years of the continued PPAP for the Downtown Tucson 2050 Plan. The planning and visioning undertaken by students helped provoke discussion and in several public discussions students were able to ask difficult questions, often perceived as taboo for professional people representing organizations. As development projects continue to be proposed downtown, the plan's aspirational vision is challenged by the immediate economic desires of today.

The measured impact on the actual carbon emissions of Tucson by the project is yet to be seen. Municipal climate planning projects in other cities have demonstrated significant reduction and public-private co-benefit on multi-year scales. Yet, there remain challenges in accurately assessing the impact of projects and policy against the ever moving baseline and measurement tools of climate change (Bulkeley 2015). The Tucson 2050 Plan will need to better articulate the methods and metrics of evaluation to make a future case for proven success.

Finally, the emerging areas of 'smart' and resilient' cities call for new approaches to the governance of infrastructure and the urban built environment (Nevens 2013). The project's multi-year PPAP will ask more direct questions in the areas of governance of infrastructure to support this emerging dialogue.

4.2 Academic Partner: Assessing the PPAP Model for Training Future Professionals

> The project introduced a new studio typology to develop student's abilities to conduct research and synthesize analysis with architectural design so that the next generation of designers are informed and capable of addressing these environmental issues. : University of Arizona Architecture Undergraduate (B.Arch '18), May 2017

> Through the hardest, or most challenging moments, we produced our best work. This multi-disciplinary studio course has given me a glimpse of my future, by preparing me for work in a real firm, where collaboration is key to a successful project. : University of Arizona Architecture Undergraduate (B.Arch '18) , May 2017

The PPAP model introduced students to multiple perspectives and methods of analysis through the diversity of public and private professional contributors. Through modeling the future resource use of Tucson and then formulate solutions, students were taught research skills in case study, spatial mapping, and quantitative analysis in addition to the design inquiry they had previously learned in their architectural education. By engaging a real context and real challenges, students learned to use an array of analytical tools in concert with design tools to devise reality-based solutions that were then critiqued by the actual development partners.

Students gained confidence in their ability to look at current and future resource use within cities and then envision a carbon and water neutral future. In their emerging careers, this skillset will be valuable. By working with city, county, and professional architects and engineers, students understanding of career options with expanded. Students also learned how practice and government can work together toward positive solutions. In the next iteration of the Downtown Tucson 2050 Plan studio this aspect is improved and strengthened. Students are paired directly with city and county staff members for a direct and consistent mentorship through the semester. An internship opportunity the summer following the course will continue to be sponsored.

4.3 Private Partner: Assessing the PPAP Model for Integrating Research and Advocacy

> I am very impressed with [the professor's] ability to lead such a diverse group of students through this process. The ideas, energy, and enthusiasm was everything we had hoped for.
> : Henry Johnstone, President, GLHN Architects and Engineers, Tucson 2050 Plan Sponsor, May 2017

The PPAP model connected architects and engineers in practice with the next generation of professionals to create mentorship opportunities. Students were exposed to multiple streams of current and emerging professional opportunities, beyond the traditional architect in practice model. Conversely, the PPAP allowed professional architects and engineers in practice to step outside of their focused projects and use their expertise toward the benefit of the planning of their future community. The expertise in practice was exploited for a better product and academics were able to share the latest research. Both were able to use their expertise for grounded advocacy to the public. The PPAP model provides a bridge between architectural academia and practice for meaningful dialogue and impact. The future iterations of the project will expand the joint speaking engagements to strengthen this model and widen dissemination.

5.0 CONCLUSION

Cities around the world have increasingly taken on the charge of climate action. Of the 1,040 signatories to the United States Conference of Mayors' Climate Protection Agreement, over 95% are small and medium sized cities. Despite ambitions to contribute to the amelioration of climate change, resource limitation for climate planning and long term planning have been consistently documents for municipalities of this size (Bulkeley 2013, Betsill 2007, Bulkeley 2005). Academia can help fill this resource gap through a Public-Private-Academic Partnership (PPAP) model. The Tucson 2050 Plan is a case study in how one medium sized city created a vision document for 2050 carbon and water neutrality for its downtown with local public, private, and academic partners. This PPAP resulted in unique benefits to each entity. Architecture students gained the analytical and design skills to take on this change through local cooperation in their future careers.

ACKNOWLEDGEMENTS

ACADEMIC: Architecture (B.Arch) Students (Jennifer Braun, Scott Hunter, Mikayla Krager, Ignacio LaRoche, Delia Martinez, Kiuk Seong, Brady Stanton) and Landscape Architecture (LAR) Students (Molly Adamowicz, Michael Cimino, Samantha Hauserman)
PRIVATE: Henry Johnstone (President, GLHN Architect + Engineers, sponsor), Russell Combs (Healthcare and Wellness Studio, GLHN Architect + Engineers), Skip Laitner (Founder + CEO, Economic and Human Dimensions Research Associates), and Eric Corey Freed (Chief Community Officer, EcoDistricts)
PUBLIC: Jason Laros (Energy Manager, City of Tucson), Irene Ogata (Urban Landscape Manager, City of Tucson and Tucson Water), Julie Robinson (Sustainability Programs Director, Pima County), Kathy Chavez (Water Policy Director), _Julia Fonseca (Environmental Planning Manager), Jonathan Mabry (Historic Preservation), Jaimie Galayda (Planning, Transportation & Sustainability Policy)

REFERENCES

Betsill, Michele, and Harriet Bulkeley. "Looking back and thinking ahead: a decade of cities and climate change research." *Local environment* 12, no. 5 (2007): 447-456.

Bulkeley, Harriet, and Peter Newell. *Governing climate change*. Routledge, 2015.

Bulkeley, Harriet, and Michele M. Betsill. "Revisiting the urban politics of climate change." *Environmental politics* 22, no. 1 (2013): 136-154.

Bulkeley, Harriet, and Michele Merrill Betsill. *Cities and climate change: urban sustainability and global environmental governance*. Vol. 4. Psychology Press, 2005.

Liesbet, Hooghe, and Marks Gary. "Unraveling the central state, but how? Types of multi-level governance." *American political science review* 97, no. 2 (2003): 233-243.

Mayors Climate Protection Center, 2017. US Conference of Mayors. www.usmayors.org/mayors-climate-protection-center (accessed December 2017).

Meadowcroft, James. "Who is in charge here? Governance for sustainable development in a complex world." *Journal of Environmental Policy & Planning* 9, no. 3-4 (2007): 299-314.

MetroLab, 2017. MetroLab Network. https://metrolabnetwork.org (accessed November 2017)

Nevens, Frank, Niki Frantzeskaki, Leen Gorissen, and Derk Loorbach. "Urban Transition Labs: co-creating transformative action for sustainable cities." *Journal of Cleaner Production* 50 (2013): 111-122.

Pima County Board of Supervisors, 2017. Pima County Board of Supervisors Climate Change Resolution 2017-39 & Resolution 2017-51: Report & Recommendations to meet The Paris Agreement. https://webcms.pima.gov (accessed November 2017).

Rosenzweig, Cynthia, William Solecki, Stephen A. Hammer, and Shagun Mehrotra. "Cities lead the way in climate–change action." *Nature* 467, no. 7318 (2010): 909.

Voytenko, Yuliya, Kes McCormick, James Evans, and Gabriele Schliwa. "Urban living labs for sustainability and low carbon cities in Europe: Towards a research agenda." *Journal of Cleaner Production* 123 (2016): 45-54.

ENDNOTES

[1] The book can be found through this link: https://issuu.com/home/statistics/publications/451a_fixed_book_final__spreads