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JULY 2020

working FUTURES GROUP
GREATER PHILADELPHIA

2050

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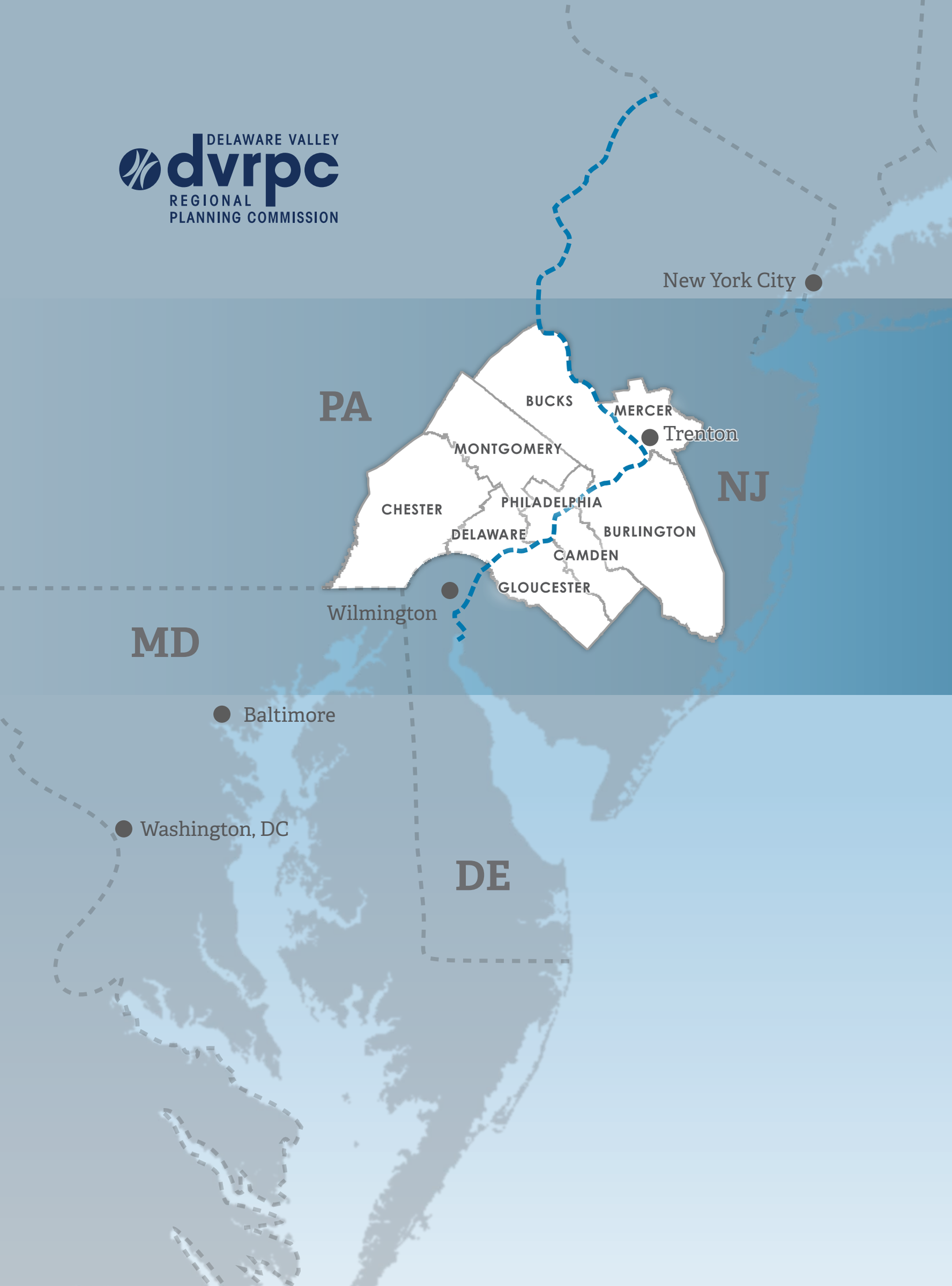
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The Delaware Valley Regional Planning Commission (DVRPC) is the federally designated Metropolitan Planning Organization for a diverse nine-county region in two states: Bucks, Chester, Delaware, Montgomery, and Philadelphia in Pennsylvania; and Burlington, Camden, Gloucester, and Mercer in New Jersey.

DVRPC's vision for the Greater Philadelphia region is a prosperous, innovative, equitable, resilient, and sustainable region that increases mobility choices by investing in a safe and modern transportation system; that protects and preserves our natural resources while creating healthy communities; and that fosters greater opportunities for all.

DVRPC's mission is to achieve this vision by convening the widest array of partners to inform and facilitate data-driven decision making. We are engaged across the region and strive to be leaders and innovators, exploring new ideas and creating best practices.

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REGIONS AROUND THE WORLD FACE AN INCREASINGLY UNCERTAIN FUTURE AS SOCIAL, ECONOMIC, AND ENVIRONMENTAL SYSTEMS ARE BECOMING MORE INTERCONNECTED AND INTERDEPENDENT.[1] EXPLORATORY SCENARIO PLANNING—A PRACTICE LONG USED BY THE MILITARY AND CORPORATIONS—IS A PROCESS THAT HELPS ORGANIZATIONS RESPOND TO UNCERTAIN EXTERNAL FORCES THAT MAY ARISE IN A FUTURE THAT CANNOT BE FULLY KNOWN.

Dispatches from Alternate Futures: Exploratory Scenarios for Greater Philadelphia is the result of the second exploratory scenario planning exercise for the Greater Philadelphia region, and is a key step in an iterative process to develop the *Connections 2050* Long-Range Plan for Greater Philadelphia.[2] A group of regional stakeholders and transdisciplinary subject matter experts—the Futures Working Group (FWG)—was tasked with generating multiple views of the future by 1) assessing uncertainty within a changing environment; and 2) understanding what conditions or events may emerge along with their likely consequences. A third step will be conducted as part of the *Connections 2050* Long-Range Plan update to identify potential actions to respond to or benefit from uncertainties.

Policymakers and public- and private-sector leaders can use this scenario exercise and the forthcoming *Connections 2050* Long-Range Plan to make informed decisions in the present that help guide the region toward more preferable outcomes as defined in the Plan's vision.

Scenario planning is a process that helps organizations respond to **uncertain external forces** that arise in a future that cannot be fully known.

INTRODUCTION

SCENARIO PLANNING: A **PRIMER**

Scenario planning is a collaborative learning process that better responds to major transformational events and technological advances by collecting participants' local knowledge and engaging them to wrestle with multiple uncertainties and implications. Traditional planning processes incorporate visioning exercises that lead to creative, but sometimes poorly defined, conceptions of the future that often have low plausibility. Scenario planning offers multiple views of the future and uses those views to clarify the vision, and gain insight into strategies that can keep the region on its desired pathway.

What will our region & world look like 20 to 30 years from now?

Exploratory scenario planning, more specifically, starts in the present and projects into the future using anticipated trends and external forces that are not under the control of participating stakeholders. Exploratory scenario planning does not try to predict the future or identify a preferred vision of it. Rather, its aim is to anticipate different ways the future could unfold. Good scenarios are stories that help us to understand what the region and world may look like 20 to 30 years from now, based on the driving forces we expect to shape the future and the decisions we make today.

The findings and narratives developed in a scenario planning exercise do not promote any particular vision for the future; propose any specific priorities; or advocate for a particular ideology, values, or goals. Rather, they are meant to examine a complex world full of driving forces and uncertainty. Scenario planning highlights the trade-offs and potential implications that result from different decisions, and exposes blind spots that may not otherwise be revealed using linear thinking.

Some of the advantages of exploratory scenario planning are that it:[3]

1. calls attention to the vast range of plausible futures;
2. considers what is certain and uncertain about the future;
3. illustrates interactions between complex system elements;
4. highlights questions that could otherwise be ignored;
5. considers possible outcomes of real crises; and
6. forces analysts to explore system details and dynamics and identify critical choices.

The globally interconnected nature of the world makes it difficult to understand the causes and effects of complex systems. Many of our greatest challenges are global issues, such as climate change, globalization, and technological development at the expense of prudence and ethics. Other global threats could come from terrorism, pandemics, famines, or nuclear or conventional war. Scenarios can help us to understand how local systems relate to interdependent, complex, adaptive global systems.

This exercise aims to identify an expansive range of futures that the region could conceivably face between the present day and the year 2050, so that the region can plan and prepare for whichever environment comes to fruition. Best practices in scenario development include[4]:

- **plausibility:** fall within the limits of what is reasonably expected to happen;
- **structural distinction:** take radically different paths in key aspects, not simply variations of a base case;
- **logical consistency:** eliminate internal inconsistencies that undermine credibility;
- **utility:** adhere to the decision focus and be useful in identifying strategic options; and
- **challenges to conventional wisdom:** expand our horizons and broaden our definition of what is possible.[5]

Black swans, such as Coronavirus Disease 2019 (COVID-19), are unexpected and unforeseeable events that have major, potentially catastrophic impacts. Exploratory scenarios may contain such events in their narratives, but these are not used as the basis for forming scenarios because they are, by definition, highly unpredictable and, therefore, seen as low probability. This report does contain considerations for how responses to the recent pandemic could affect each scenario, but it does not give a holistic look at all possible outcomes. See the 2020s Breaking News and Decade Overviews for more detail.

PROCESS

Beginning in early 2019, a group of approximately 100 regional subject matter experts—the FWG—assisted DVRPC staff in their second exploratory scenario planning exercise. The FWG is a collaborative, transdisciplinary task force that assists DVRPC staff in using exploratory scenario planning to understand how various forces—social, technological, environmental, economic, or political—are shaping the region, and helps identify ways to better respond to or benefit from those forces.

The main goal of the scenario planning exercise conducted with the FWG was defined by the collectively agreed-upon research statement:

"Characterize and test uncertainty from societal, technological, economic, environmental, and political trends and forces in Greater Philadelphia between the present and 2050, which may:

- *pose new opportunities and risks;*
- *affect predictability in regional demographics, economy, land use, infrastructure, and travel patterns; and*
- *impact the region's ability to achieve its vision."*

THE MAIN GOAL OF THE SCENARIO PLANNING EXERCISE CONDUCTED WITH THE FWG WAS DEFINED BY THE COLLECTIVELY AGREED-UPON RESEARCH STATEMENT:

Characterize and test uncertainty from societal, technological, economic, environmental, and political trends and forces in Greater Philadelphia between the present and 2050, which may:

- pose new opportunities and risks;
- affect predictability in regional demographics, economy, land use, infrastructure, and travel patterns; and
- impact the region's ability to achieve its vision.

In its initial meeting, the FWG brainstormed 170 forces and nominated 41 forces for further consideration. DVRPC staff consolidated the list of nominated forces down to 15 working-list forces. In the second meeting, the FWG revised this list to 18 different voting-list forces:

Clean Energy: more willingness to be off the grid, reduced cost of renewable energy, and advances in storage and microgrids revolutionize energy production and distribution;

Climate Change: worldwide disruptions resulting from rising oceans, more severe storms and storm surges, increased rainfall in some areas and drought in others, and higher temperatures with more extremes;

Delivery on Demand/End of Brick-and-Mortar Retail: trends intensify toward more e-commerce, shrinking retail square footage, and increased package delivery;

The Digital Revolution: robotics and artificial intelligence and other digital technologies drastically change work, lifestyles, education, healthcare, and transportation;

Disintegration of Social Cohesion: lower trust in institutions, and people moving more frequently and having shorter-term jobs, limits the ability to form close relationships, reduces civic and social participation, and increases divorce and addiction rates;

Disruption of Meds and Eds: the region's economy is thrown into turmoil as these key industries digitize, reducing the importance of place in higher education and healthcare;

Fundamental Change in Mobility: trip frequency and length, and willingness to share space, increase due to shared mobility services and new transportation technologies;

Greater Philadelphia in the Global Economy: Greater Philadelphia and the Northeast megaregion expand global value chain connections—attracting and growing new exporting industries—thanks to an increasing global middle class;

Housing Shortage: growing demographic and household diversity outpaces the region's (and nation's) housing supply, requiring more co-generational, infill, and affordable units;

Income Redistribution: tax policies, universal basic incomes (UBIs), and other redistribution mechanisms are employed in response to rising inequality;

International Upheaval and (Im)Migration: refugee crises, food shortages, civil unrest, authoritarianism, terrorism, and climate change increase population movement and disrupt trade and supply chains;

Public Health Crisis: failure to treat chronic illness root causes, climate change, declining antibiotic effectiveness, and other issues increase health problems and shorten lifespans;

Reinventing Infrastructure and Its Financing: new technologies require the public sector to find new ways to fund maintenance, technological, and other infrastructure needs;

Shifting Demographics and Location Preferences: economic and demographic forces increase demand for compact, walkable communities;

Social and Political Dysfunction: increasing polarization reduces ability to advance legislation, increasing risk for soft and hard infrastructure, and making big problems harder to solve;

Socioeconomic Inequality: continuing and growing income and wealth gaps propel disparities within and between cities and regions, leading to physical hyper-segregation and inequitable access to jobs, healthcare, education, and other goods and services;

Technocracy: large organizations concentrate power through massive information collection, real-time systems, Big Data analytics, artificial intelligence (AI), and winner-take-all economics; and

Waste Management: increasing waste flows reach crisis levels as China refuses to take more materials; greater collection needs slow traffic and add to curb space demand.

An online voting platform asked FWG members to consider the uncertainty, impact, and likelihood of each force.

Participants identified seven forces as both high impact and high uncertainty. DVRPC staff combined these seven forces, based on similarity in their focus, into three axes of uncertainty:

1. The Digital Revolution and Fundamental Change in Mobility;
2. Socioeconomic Inequality, Housing Shortage, and Shifting Demographics and Location Preferences; and
3. Climate Change and Clean Energy.

These high-impact, high-uncertainty forces have a variety of potential implications for the region.

IMPACT, UNCERTAINTY RELATIONSHIPS FOR VOTING-LIST FORCES

SOURCE: DVRPC, 2019.

THE DIGITAL REVOLUTION & FUNDAMENTAL CHANGE IN MOBILITY

The Digital Revolution has moved the economy away from industrial-era production and toward the creation of information and content. It emerged starting in the 1960s around a set of interrelated technologies: ubiquitous computing; mobile and broadband internet access; the proliferation of digital devices; the declining cost and rising capacity of data storage; and sensors that gather data, process it, and turn it into actionable intelligence.

The Digital Revolution has been reshaping nearly every industry in an ongoing process that:

1. connects people with each other and more and more things to the internet;
2. creates new options (fragmentation);
3. drastically increases data collection and availability;
4. reduces transaction costs;
5. allows actions to be completed remotely;
6. facilitates greater customization and personalization;
7. flattens distance and the cost of distance;
8. empowers user-driven networks;
9. enables real-time communications; and
10. replaces low-digital jobs with high-digital ones.

It is currently evolving around robotics, AI, quantum computing, virtual and augmented reality, connected vehicles (CVs) and automated vehicles (AVs), smart cities and the Internet of Things, and 3D printing. Since many of these technologies are early in their deployment, it is harder to forecast their longer-term implications, which could either reinforce the outcomes of the initial set of digital technologies or go in entirely new directions.

A central question for this exercise is whether digital technologies will be used in the future to centralize economic power into fewer and fewer hands through intellectual property and proprietary information; or if they will be able to decentralize economies through open source approaches, collaborative peer-to-peer networks, and distributed production. A closely related question is whether increased protection of personal data will offer individuals more control over the collection and use of their information, or if large organizations will continue to be able to collect and use personal data to strengthen their control over the economy. Another uncertainty, less explored here, is how digital technologies shape human behavior.

In scenarios with a high level of vehicle automation, there is expected to be a fundamental change in the willingness to travel. This could mean an increase in travel frequency, trip length, and willingness to share space.

SOCIOECONOMIC INEQUALITY, HOUSING SHORTAGE, AND SHIFTING DEMOGRAPHICS & LOCATION PREFERENCES

Growing income and wealth disparities propel inequities within and between regions. Nationally and globally, the wealthy shape public policy and consumer markets to their benefit, which increases distrust and social friction. Inequality is increasing between regions, as economic "superstar" regions extract wealth from those that have been less successful in the digital age.

Statistics corroborate the feeling that there is growing inequality between the rich and the poor, and a shrinking middle class. Since 1980, there has been increasing divergence in income levels between the top 10 percent of all U.S. earners and the bottom 50 percent. While the top 10 percent took in 34.2 percent of income in 1980, they received 48.0 percent in 2018.[6] The bottom 50 percent of all earners received 19.9 percent of total income in 1980, which decreased to 12.2 percent in 2017.[7] Significant differences in income have also been noted across gender, where women earned just 82 cents for every dollar earned by men in 2017.[8] Average earnings vary considerably by race as well. In 2017, Asian men are the top average earners, with an average weekly pay of $1,207.[9] White men made 80 percent of this figure, Black men earned 59 percent of it, and Hispanic men 57 percent as much.[10] Asian women were the top female earners in 2017, with an average weekly pay of $903.[11] White women earned 88 percent of this figure, Black women 73 percent, and Hispanic women 57 percent as much.[12]

Household wealth has an even greater disparity, and even if incomes were to equalize, it would still take considerable time for minority groups to catch up. For example, the Federal Reserve's 2017 Survey of Consumer Finances found that mean and median family wealth for white households are $933,700 and $171,000 respectively.[13] Black households have a family wealth that is less than 15 percent as much, with a $138,200 mean and $17,600 median.[14] Hispanic families' mean and median wealth is around 20 percent that of white households, with a mean of $191,200 and a median of $20,700.[15] Thomas Piketty's landmark book, *Capital in the 21st Century*, showed that when the return on capital (through profits, dividends, interest, rents, and other forms of capital) is greater than the growth in economic output, wealth tends to further concentrate in the hands of those at the top.

In Greater Philadelphia, growing socioeconomic inequality can be seen through a shrinking middle class, a shortage of affordable housing, gentrification and displacement as population moves back into urban centers, a lack of intergenerational wealth and access to capital for people of color, and unequal levels of job opportunity and training. Access to quality housing is one of the single biggest determinants of individual health outcomes. Unequal income levels also raise concern about access to opportunity and all kinds of goods and services, such as: housing, emergency response, healthcare, fresh food, parks and

open space, retail, banking, transportation, and education. Disparities in wealth exacerbate other social divisions along lines of race, gender, and citizenship status; and can undermine democracy through unequal political influence. These disparities also feed into racist, ethnonationalist and anti-immigrant political ideologies, as well as countermovements to them.

While nearly every person may have their own definition of equity, a general definition for it is the just and fair inclusion in a society where everyone can participate, prosper, and reach their full potential. The central question for the scenarios is whether society will take action on reducing these disparities or will allow the status quo to hold, which could mean these disparities worsen over time. Related to this question is whether or not there will be enough affordable housing and potentially new types of housing that can meet the needs of an aging population, more immigration, and other sociodemographic changes.

CLIMATE CHANGE & CLEAN ENERGY

Severe weather events and changes to our climate due to global warming pose threats to both the environment and the economy. Global warming is widely recognized as the result of rising levels of greenhouse gases (GHGs) trapping heat in the atmosphere.

GHGs are predominantly formed by the burning of fossil fuels. In Greater Philadelphia, climate change is expected to increase precipitation and cause more frequent and intense storms. Sea level rise combined with increased precipitation may lead to more coastal and nuisance flooding. Rising temperatures, with more variability, are likely to mean more days with temperatures greater than 90° F. More freeze-thaw cycles in the winter will harm transportation infrastructure and cause other damage. As impacts may be greater in other parts of the world, the region could see an increase in climate refugees. A variety of new health concerns could emerge, such as increasing heat-related deaths and tropical diseases becoming more prevalent.

Clean energy technologies hold promise in responding to climate change. A revolution in energy production and distribution is possible when combined with increased consumer willingness to be off the grid; reduced cost of solar, wind, and other forms of renewable energy; improved battery storage technologies; and microgrids.

The central question for climate change in these scenarios is whether humanity can collectively eliminate human-induced GHG emissions, particularly by quickly developing clean energy.

FOUR ALTERNATE SCENARIOS IN 2050

The high-impact, high-uncertainty forces were organized into axes of uncertainty to create four radically different future scenarios. The climate change and rising inequality forces were combined into one axis based on joint uncertainty of whether the future will see high levels of political polarization, versus political will and collective action around these issues. The second axis of uncertainty considers whether technology—primarily from The Digital Revolution—will cause incremental or transformative change by the year 2050.

These axes of uncertainty were used to create four scenarios. In Delayed Expectations the world is overcome by climate change and economic slowdown. In People Power grassroots movements point to a more just and sustainable future. A handful of Big Tech companies control the economy in Technology in the Driver's Seat. And in Inclusive Tech a new equitable economy emerges through open source technologies.

4

> " Scenarios today explore the long-term consequences of decisions and trends...In this view, the goal of planning is to make more intelligent decisions today, not to achieve perfect knowledge of the future. "
>
> ROBERT GOODSPEED, *SCENARIO PLANNING FOR CITIES AND REGIONS*

FOUR SCENARIOS

SOURCE: DVRPC, 2019.

None of these scenarios are seen as optimal or preferred futures for Greater Philadelphia. Rather, they show the opportunities and challenges in how key driving forces may shape the region over the next several decades, and how the decisions we make and our reactions to these forces may shift their implications.

There is an inherent tendency to ask which of these scenarios is the most probable. This is not a useful exercise, as the probable future we are planning for most likely lies within the range of the scenarios identified. This exercise is not intended to predict exactly what the future will look like in 2050; rather, it should be used to inform our understanding with the best information we have in the present to guide our decision making today and into the future. This exercise should be updated when trends and reality move beyond the future envisioned in these scenarios, although they can be updated sooner if deemed beneficial.

SCENARIO ASSUMPTIONS AND IMPLICATIONS

FOCUS AREA	DELAYED EXPECTATIONS	PEOPLE POWER	TECHNOLOGY IN THE DRIVER'S SEAT	INCLUSIVE TECH
 CLIMATE CHANGE AND ENVIRONMENT	Climate change advances far more rapidly than forecasted; inability to reduce GHG emissions means that geoengineering is increasingly seen as the only solution.	Focus on deploying readily available technologies to slow climate emissions, and proactive retreats from coastal and low-lying areas.	GHG emissions continue to rise, creating economic, societal, and environmental risks.	Carbon taxes and regulatory incentives are used to stimulate clean technology innovation; investment in direct air capture technologies that pull climate from the atmosphere; and proactive retreats from coastal and low-lying areas.
 DEMOGRAPHICS	Increasing chronic health conditions shorten lifespans; lack of social safety net reduces birth rates; climate refugees are on the rise, but many residents are also leaving Greater Philadelphia.	Increased social safety net, including better parenting support and universal healthcare, leads to higher birth rates; climate change is bringing more people from the Eastern Seaboard to the region.	Major healthcare breakthroughs are extending lifespans for those who can afford them.	Universal healthcare and new drugs improve health outcomes for nearly everyone, extending lifespans across the board; birth rates drop as more people care for elderly relatives.
 THE ECONOMY AND WORK	Jobs do not change much but do use more technology; continued growth in freelancing and gig economies.	Jobs look similar to today but continue to displace low-skill positions with high-skill ones; cooperatives and benefit corporations become the principal business structures.	A handful of large, monopolistic firms use data to dominate the economy; automation displaces some jobs, while technology requires more workforce skills.	Digital fabrication democratizes the means of production, reducing scarcity and deconcentrating economic power; work weeks shorten, and more people work for themselves.

FOCUS AREA	DELAYED EXPECTATIONS	PEOPLE POWER	TECHNOLOGY IN THE DRIVER'S SEAT	INCLUSIVE TECH
 INEQUALITY	Economic growth is slow, with more income going to those at the top as attempts to retrain and retool the workforce for modern economic needs have not kept up.	Governments invest heavily in education and workforce retraining, and try to both deconcentrate poverty and prevent low-income and minority communities from displacement.	Universal basic income (UBI) substitutes for hard-to-come by work.	Governments increase education funding and modernize curriculums, create community jobs, pay caretakers for their work and individuals for their data, and work to broaden capital ownership.
 HOUSING AND DEVELOPMENT	Low-density communities struggle to keep up with maintenance of infrastructure as it ages.	Governments continue to subsidize existing low-density development in order to keep housing affordable while trying to improve walkability.	Development patterns continue to recentralize until highly automated vehicles (HAVs) arrive, leading to more decentralized land uses.	Automated technologies are applied to small, mobile housing units that enable relocation for work and quick evacuation from emergency situations.
 TRANSPORTATION INFRASTRUCTURE AND FINANCING	Revenues move to mileage-based fees but are not set at a level that catches up on road maintenance needs.	Revenues shift to a fee based on the amount of VMT each property generates along with a tradable driving credits system, where each person gets an annual allotment of VMT; this helps pay for major new transit investments around the country.	Congestion pricing is used to curtail traffic and emissions but leads to significant road expansion and a focus on maintaining higher-volume roads; calls to privatize the most profitable roads to better address maintenance and keep technologies up to date.	Funding significantly increases thanks to carbon taxes but then decreases as emissions levels decline; these taxes also incentivize less carbon-intensive forms of transportation and infrastructure.
 TRANSPORTATION TECHNOLOGY	Technological limitations have stymied efforts to create HAVs; little investment in CV technologies.	HAV rollout has been challenged by technology and business model problems; in response, the federal government is piloting truck platoons and automated shuttles, and implementing CV technologies.	HAVs, which can operate in designated zones, are deployed before anyone is ready for them; CV technologies are not pursued.	Quantum computing and artificial general intelligence (AGI) help to speed up HAV development and deployment of vehicles that bear little resemblance to traditional cars and trucks.

SOURCE: DVRPC, 2020.

SCENARIO ASSUMPTIONS & IMPLICATIONS

Beyond the forces used as their basis, each scenario is generated by a collection of underlying assumptions that propel the Greater Philadelphia region into very different futures. The table on the preceding pages provides a detailed look at the assumptions used to develop each of these scenarios.

PERCENTAGE CHANGE IN KEY REGIONAL INDICATORS BY SCENARIO, 2015–2050

FACTOR	DELAYED EXPECTATIONS	PEOPLE POWER	TECHNOLOGY IN THE DRIVER'S SEAT	INCLUSIVE TECH
POPULATION	–1%	+10%	+15%	+8%
POPULATION <16	–18%	–9%	–15%	–19%
POPULATION >65	+44%	+53%	+68%	+70%
WHITE, NON-HISPANIC POPULATION	–11%	–14%	+1%	–10%
MINORITY (NON-WHITE) POPULATION	+17%	+50%	+38%	+37%
EMPLOYMENT	+3%	+11%	+16%	+5%
HOUSEHOLDS	+1%	+16%	+26%	+21%
SINGLE-PERSON HOUSEHOLDS	+3%	+31%	+51%	+47%
PERSONS PER HOUSEHOLD	–1%	–6%	–10%	–11%
LOW-INCOME HOUSEHOLDS	+5%	+5%	+30%	+14%
MEDIUM-INCOME HOUSEHOLDS	–1%	+31%	+16%	+34%
HIGH-INCOME HOUSEHOLDS	-11%	+8%	+34%	+11%
VEHICLES	+5%	+17%	+5%	+13%
VEHICLE MILES TRAVELED (VMT)	–4%	–5%	+53%	+21%
VEHICLE TRIPS	–4%	0%	+31%	+34%
TRANSIT TRIPS	–1%	+20%	+9%	+31%
WALKING/BIKING TRIPS	+13%	+29%	–4%	+17%

SOURCE: DVRPC, 2020.

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DVRPC used the assumptions and dialogue with the FWG to develop the scenarios and modeled them using two platforms. A summary of the FWG discussion can be found on the Futures Group web page "minutes/highlights" for the February, March, April, and May 2019 meetings.[16]

The first model, Impacts 2060, is an open source, sociodemographic system dynamics model that can develop future-year population and employment, based on changes to birth rates, death rates, migration rates, and economic conditions; and project resulting shifts in travel demand and land use. DVRPC worked with Resource Systems Group, the model developer, to update the Impacts 2050 model by incorporating new data into demographic transition and travel demand equations by adding subregions, accounting for shifting generational travel preferences, adding land use types and five-year age cohorts, creating a population-to-household conversion table, and changing the base model year to 2010.

The second model, UrbanSim, simulates regional real estate developer and household locational choices and how these are influenced by government policies and investments. These models were used to further understand and illustrate how the differing future assumptions could shape the region's demographics, travel demand, and land use. This is illustrated in the table on the facing page.

The following sections of this report provide overviews of each scenario over the 2020s, 2030s, and 2040s. They give a glimpse into each future through a series of science fiction news articles, as derived from the FWG scenario planning exercise, and extensive research and modeling by DVRPC. The implications detailed in these articles, along with the vision established by and for the Greater Philadelphia region, will be the basis for strategies that will be included in the *Connections 2050* Long-Range Plan.

Each scenario has a set of focus areas for the articles, which relate back to key issues in the Long-Range Plan:


ENVIRONMENT


DEMOGRAPHICS


THE ECONOMY


INEQUALITY


HOUSING


TRANSPORTATION INFRASTRUCTURE AND FINANCING


TRANSPORTATION TECHNOLOGY

DVRPC will use these scenarios to better understand the many ways the future could unfold from the present-day situation. This will help shape the vision and strategy identification phases of the *Connections 2050* Long-Range Plan update. Strategies will be both adaptive and universal. Adaptive strategies are seen as beneficial to a specific scenario but may be counterproductive in others. Universal strategies are seen as beneficial across a range of different futures. Universal strategies are broken up into short-term, low-risk strategies that will not set the region in any negative path dependence or technology lock-in directions. Medium- and long-term strategies are generally a heavier lift and may require more time, effort, and expense to implement.

SIGNPOSTS

Signposts are actions, events, or indicators with specific thresholds that can help to determine if the future is more closely following one scenario's track than the others'. Crossing a signpost suggests that relevant contingent actions—to be developed in a later phase of the *Connections 2050* Long-Range Plan—should be taken for that specific future.

Some signposts for **Delayed Expectations** include:

- The COVID-19 pandemic subsides with no real lessons learned or fundamental changes, so the early 2020s look a lot like 2019.
- Climate change occurs at a much faster rate than generally predicted.
- Political polarization is entrenched, with sudden and rapid swings between political extremes.
- Limitations with technology lead to a new AI winter, AV development stalls, and stagnating innovation.
- The number of renters and gig economy workers increases.

Some signposts for **People Power** include:

- The United States returns to global climate agreements.
- Major federal legislation bolsters antitrust regulations, creates universal healthcare coverage, increases funding for transit, and/or strengthens worker protection.
- The ability of private-market actors to collect personal data is significantly limited.
- B Corps and cooperatives grow significantly.

Some signposts for **Technology in the Driver's Seat** include:

- Industry-friendly HAV legislation and/or HAVs, which can fully drive themselves within a designated zone, are made commercially available by 2025.
- Technology companies consolidate their position at the top of the economic hierarchy (displacing finance).
- Technology displaces high-skill jobs and creates more low-paying ones.
- Smart grid investments centralize energy infrastructure, rather than decentralizing it.
- Population groups become even more sorted geographically by political affiliation, race, education, and income, particularly as a result of increased remote work.

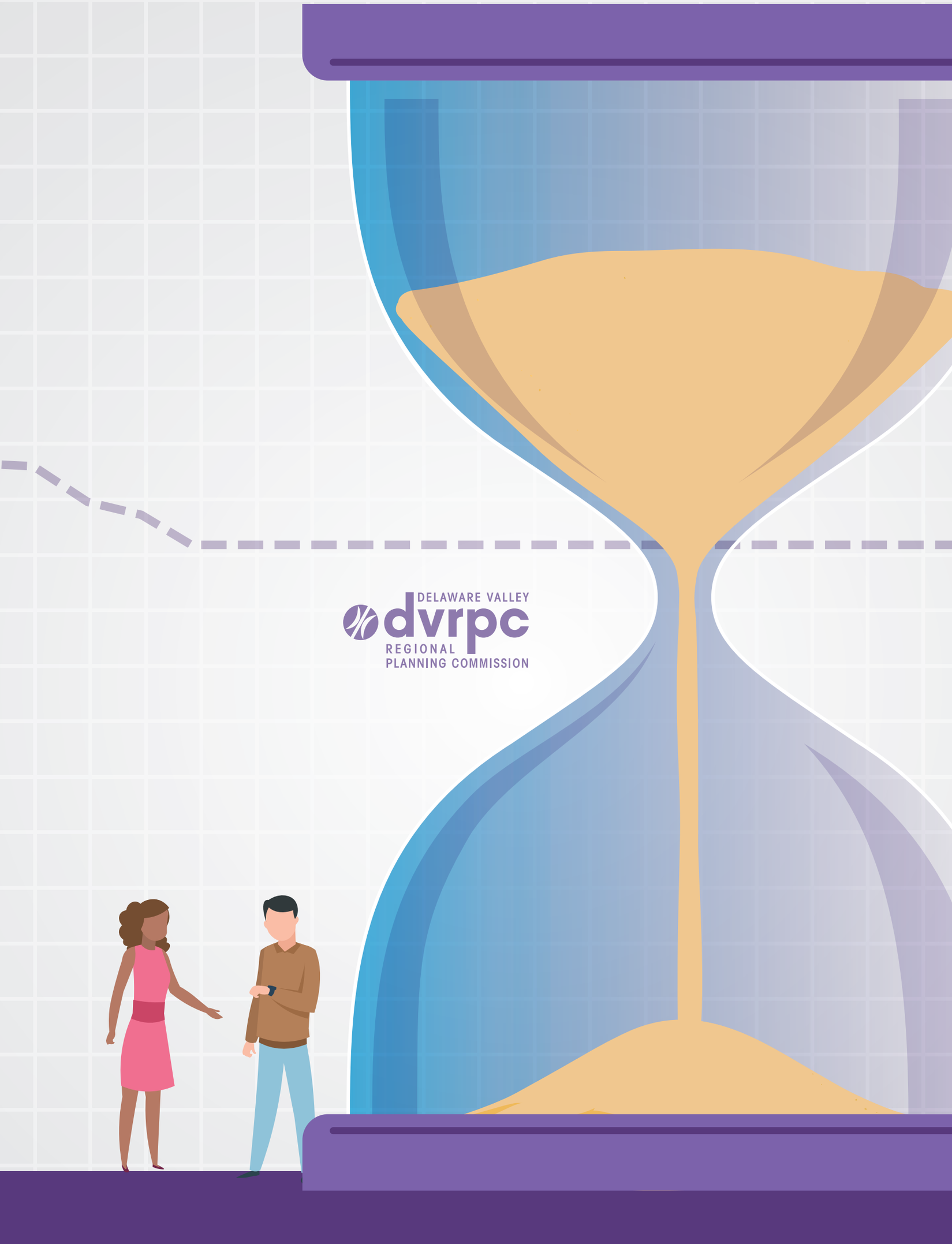
Some signposts for **Inclusive Tech** include:

- Social media and other internet companies find ways to successfully stop the spread of misinformation, disinformation, and hate while protecting individual and civil rights.
- Federal incentives and regulations are geared to promote clean technology innovation and deployment.
- Open source principles enable users to contribute to all kinds of innovation and design activities, and empower individuals.
- A Data Bill of Rights is enacted, nanopayments are provided in exchange for personal data, and/or individuals gain more control over personal data collection.

There are many potential pitfalls identified in these futures, and this report does not shy away from them. The good news is that the future is not yet written. By understanding potential risks, we can better prepare ourselves to counter them and arrive at a more positive and desirable future state. ■

“ **Scenarios are stories.** They are works of art, rather than scientific analyses. The reliability of (their content) is less important than the types of conversations and decisions they spark. ”

ARIE DE GEUS, *THE LIVING COMPANY*[17]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The following section provides a glimpse into a possible future—characterized by high deference to market forces and reliance on individual responsibility, as well as incremental change in technology—through a series of fictional news articles. None of these articles are seen as optimal or preferred futures for Greater Philadelphia. Rather, they show the opportunities and challenges in how key driving forces may shape the region over the next several decades, and how the decisions we make and our reactions to these forces may shift their implications.

Climate change, sharp political swings, ongoing civil discord, and a slowdown in innovation lead to a lack of direction and economic stagnation.

DELAYED EXPECTATIONS

dvrpc

2020s

DELAYED EXPECTATIONS

Rather than illuminating the world, ubiquitous Big Data is often of poor quality and increases uncertainty, as market and public actors analyze, understand, and react to it in different, often conflicting ways. Technology suffers a massive loss of trust due to surveillance fatigue; increasing cyberterrorism; lack of reliability of the internet; and concerns about 5G deployment, ranging from national security to community design as it requires erecting new wires, poles, and digital equipment. Mother Nature continues to unleash infectious diseases, hotter weather, sea level rise, fires, and flooding; worsening the steep economic decline that started with the COVID-19 outbreak. Trade wars and a less connected world further slow the global economy.

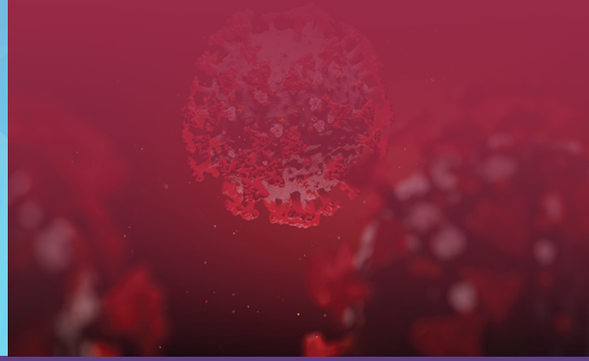
As transportation funds run low, infrastructure conditions continue what has been a long-term decline, hastened by climate-driven, severe weather. Without new incentives for sharing, or more efficient transportation options, people hold on to their cars. ■

December 13, 2027

BREAKING NEWS

New Novel Coronavirus Raising Concerns about Another Global Pandemic

A new novel coronavirus (COVID-27) is rapidly spreading around the world and could shut down the economy just as there are finally signs of recovery. Ongoing political sniping over the COVID-19 response suggests we have not learned from recent missteps. The federal government has bowed out of international efforts to streamline vaccine development. Other big questions loom. Have we done enough to rebuild the strategic national stockpile of personal protective equipment and medical supplies? Can we set up isolation centers to keep entire households from becoming infected? Can we trace the contacts of those who become sick? Can we retrofit hospitals and produce needed medicines and medical equipment? The world got lucky when COVID-19 mutated into less harmful strains in 2021. If this new novel coronavirus is as contagious as the last one, the results could be even more disastrous.



January 14, 2024

Climate Refugees Compound Crisis on Southern Border

The humanitarian crisis at the U.S. southern border has reached a new breaking point, with nearly 1,000 new migrants showing up every day and finding no place for respite after their long travels. Whereas a large majority of migrants during the 2010s were reported to be fleeing gang violence and poverty,[18] the wave of the 2020s has increasingly been the result of climate change and extreme weather in Central and South America.

The World Food Program has declared the food shortages in Guatemala, El Salvador, Honduras, and Nicaragua a catastrophic famine, affecting over four million people throughout the Central American Dry Corridor, which extends from southern Mexico to Panama.[19] Many of the migrants are subsistence farmers who have been especially hard hit by what is now on record as the longest drought recorded in the Americas.[20]

"We must reach across the aisle and develop a robust resettlement program," argues María Hernández Lopez, Professor of American Studies in the College of Arts and Sciences at Cornell University. Hernández briefed policymakers in Washington, DC, last month on the asylum classifications that put climate refugees at a particular disadvantage. "The term *refugee* is defined very precisely in international law," she explains. "In U.S. law, for example, refugees are defined as individuals persecuted because of race, religion, nationality, membership in a particular group, or political opinion. Nowhere does climate figure into it. It leaves this entire group of people without international protection or recognition."[21]

In the absence of a resettlement program in the United States, organizations like the United Nations High Commissioner for Refugees have been providing aid, but it is hardly enough. Refugee camps like the one in Ciudad Juárez, Mexico, located just 10 miles south of El Paso, are bursting at the fences.[22] Ciudad Juárez itself holds some 50,000 migrants unable to reach the United States and fearful to leave the camp.

As immigration continues to be restricted in every way possible, it is not just the migrants who are being harmed. Agricultural and business operations throughout the United States have a hard time finding badly needed workers. Many slow-growth regions, including communities throughout the country, including those in Greater Philadelphia, continue to struggle due to a lack of migrants helping to breathe new life into local economies.

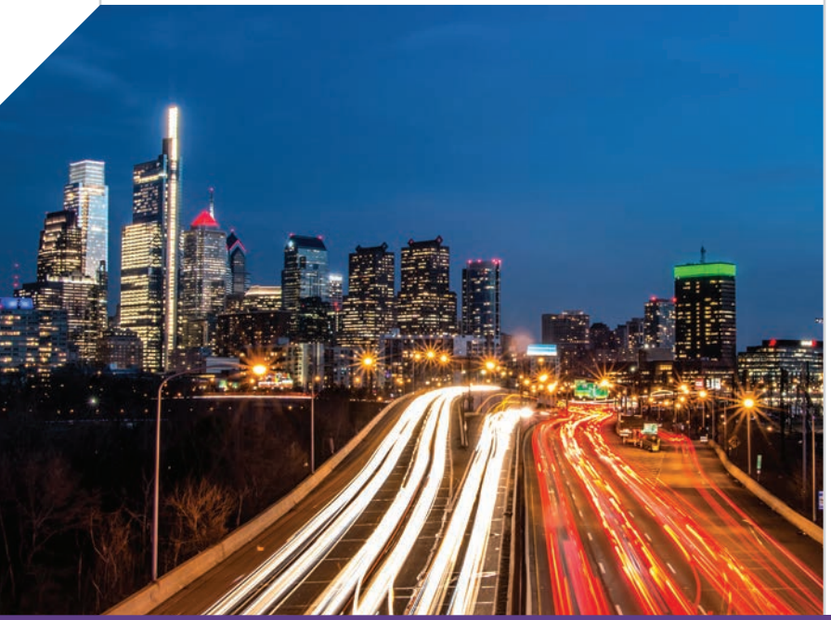
Still, no progress is being made on Capitol Hill to alleviate the crisis. This hotly contentious issue has been a rallying cry from both the Democratic and Republican presidential candidates, but consensus is nowhere to be seen. ■

July 31, 2028

Congress Narrowly Passes Transportation Legislation, Shifts Funding Mechanism to VMT Fees

Just before adjourning for its August recess, Congress narrowly passed the Funding an Equitable, Accessible, and Sustainable Transportation Infrastructure Act (FEASTIA), a six-year, $480 billion spending bill that includes sweeping changes to financing the nation's roads, bridges, and transit systems. This dramatic new legislation follows more than two years of continuing resolutions of the American Transportation Infrastructure Act of 2021.

The legislation eliminates the federal gas tax (18.4 cents per gallon for regular and 24.4 cents for diesel) and replaces it with a mileage-based user fee (MBUF) of 2.0 cents per mile traveled for light-duty cars and trucks, and 2.5 cents per mile for medium- and heavy-duty trucks. U.S. Secretary of Transportation Jason Kleine notes, "A driver traveling 10,000 miles per year can expect to pay $200 in federal transportation taxes, far less than the cost of a daily cup of coffee." Currently such a driver pays about $50 per year, assuming 40-miles per gallon fuel efficiency. Although still less than 2 percent of the total fleet, electric vehicles (EVs) will go from paying no gas tax to paying the same as all other vehicles. EVs will be mandated to have a transponder, while older gas-powered engines will be able to have their odometer read each time they fill their gas tank.



FEASTIA will renew the depleted Federal Highway and Transit Trust Funds, which have required more than $110 billion in General Account transfers since 2022 in order to fund current expenditures. The new legislation moves back to a user-pays system and injects a 25 percent funding increase while offering potential long-term revenue growth as vehicle miles traveled rises. These additional funds are seen as critical to shoring up the nation's long-crumbling infrastructure.

Two states, Oregon and Indiana, already have MBUFs. They served as the model for this new federal legislation. American Association of State Highway Transportation Officials (AASHTO) Executive Director Brandy Hendrix expects that "most states will follow the federal government's lead and move toward the MBUF."

Critics contend that the MBUF has privacy risks, insufficiently impacts greenhouse gas emissions and congestion, puts low fees on the heavy vehicles that most burden roads, masks the cost of building and maintaining roads, and rewards less fuel-efficient vehicles. There is also a concern that FEASTIA will not generate enough revenue to meet the existing backlog of repair needs, prepare for future technologies, or meet other goals. The difficulty of both passing this new funding mechanism and historic federal gas tax increases create concern that future rate adjustments will prove equally difficult. ■

September 17, 2029

Following Fatal Passive Hacking Crash, Autodrive Is the Latest Self-Driving Car Company to Shut Down Operations

Last month's multiple fatality crash caused by AutoDrive's automated vehicle (AV), operating in a roadway pilot test, has been fatal for the company and is causing a ripple effect throughout the industry. After immediately suspending all on-road testing operations, AutoDrive now says it will join a growing line of developers that have shut down their AV programs.

The crash itself is noteworthy in showing how difficult it is to prepare AV technologies to operate in complex, real-world conditions. A missing stop sign was the primary cause of the crash. After failing to stop at the intersection, the AV was hit by an oncoming, fast-moving vehicle, killing the AutoDrive test driver, as well as the driver of the other vehicle. While most people would know to stop at this location, the artificial intelligence (AI) used in AVs lacks the intuition and learning that would have saved these two lives. While most concern about hacking AVs has been about something malicious done to the digital communications system, this crash shows the risks of missing or changing elements from the built environment that AVs use to conduct their operations.[23]

"I expect this to be a temporary blip, and the industry will be back," says University of Pennsylvania electrical engineering professor Garrett Dwyer. "The industry has moved the state-of-the-practice forward, and has shown that what was once theoretical can be achieved—but it's also a cautionary note that a lot of time and investment are still needed to fully get there."

Road testing has not proven AVs to be safer than people. The AV crash rate stubbornly remains twice that of human drivers, and AVs have now been responsible for dozens of fatalities. One major challenge is that AI systems being used to power them are not very good at learning.[24] AVs have now driven several billion miles but still cannot match the skill levels that people can reach with a few dozen hours of training. It is difficult to prove the safety of vehicles consisting of millions of lines of code.

A fully automated luxury future seems to be receding further and further into the horizon. The huge expenditures that many auto manufacturers and tech companies bet on machine-learning AI have not paid off. The companies that remain hope to get the federal government more involved in funding future research, but this seems unlikely, given ongoing austerity measures and climate challenges. The failure to develop this technology means communities may need to rethink their strategies for solving large-scale transportation problems, including concerns about safety, equity, climate, and achieving other large-scale goals. ■

2030s

DELAYED EXPECTATIONS

Hurricane Theresa ravages much of the East Coast, including the Greater Philadelphia region. Grassroots organizers raise enough money to rebuild in the face of FEMA shortages, but as flood insurance becomes more difficult—and expensive—to obtain, the wealthy become the only ones able to rebuild post-disaster. Housing shortages and homelessness are on the rise as a result. Following the devastation of Theresa, more people are leaving the region than coming into it. Meanwhile, hotter weather is straining the electrical grid, and brownouts become commonplace.

While the stagnant economy has meant declining VMT, transit ridership holds steady even as conditions and reliability deteriorate. Machine learning's limitations have led to a slowdown in the research and development surrounding AGI. Legacy automakers and transportation network companies (TNCs) are the primary beneficiaries of HAV development stalling out. But many of the decisions made over the past two decades, both publicly and privately, based on the supposed imminence of these transformative technologies, look increasingly bad in hindsight. ■

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March 14, 2032

Hedge Funds Become World's Largest Landlord

What was once viewed as a basic human need is increasingly being seen as a financial instrument. Global capitalism's centuries-long search for investments that are surrounded by a protective moat has led to a focus on housing, especially as other opportunities have been limited by slow economic growth.[25] This has created housing challenges particularly at the low end of the market, where more affordable rentals are being upgraded in order to charge higher rents. This process has created an affordable housing crisis.

Challenges surrounding affordability and homeownership have been perpetuated by an economy that continues to go through severe bust cycles with only small booms. This has paved the way for large real estate companies and hedge funds with deep pockets to scoop up units for pennies on the dollar. At the same time, climate change is wreaking havoc on the nation's housing supply and exacerbating the shortage of housing units. Decades of NIMBYism and tight restrictions on new housing development have not helped matters. Beyond a shortage of units, there is a mismatch of supply. This is particularly due to the rise in single-person households, who are not looking for 3,000-square-foot suburban residences.

As fast-rising rents, falling homeownership rates, population displacement, and a rise in homelessness and multigenerational households become the norm, young people have a hard time establishing themselves in the community they grew up in. Low-income and minority populations have a hard time staying in their preferred communities. And housing increasingly comes with all kinds of bells and whistles that not everyone needs or wants. Cheng Ming, an e-commerce service manager, was recently in the market for an apartment in the Exton area of Pennsylvania. Finding an affordable place to live was made more difficult. "Everywhere I went kept trying to upsell me on additional services, when all I was looking for was a nice, quiet place to live. I don't want a talking refrigerator anyway."

As homeownership declines, fewer people are able to tap into what remains one of the strongest mass wealth-building instruments ever available. Reversing this trend will require building more residential units, particularly in high and dry areas. Doing this may require revising local zoning codes to allow a greater mix of residential housing types with increased densities. For example, allowing more small, multifamily apartment buildings can effectively add density to desirable neighborhoods without compromising their character. It could also involve streamlining plan review and permitting processes. ■

January 31, 2035

Gig Economy All That's Left?

One could be forgiven for taking up a "side hustle" in 2015 and championing the flexibility and extra income as a win for everyday workers seeking their own hours, a creative outlet, or simply an escape from the monotonous 9 to 5. The promise of autonomy, though, was a false one, and a century of workers' rights has now been all but eroded—largely at the expense of the disappearing middle class and the disadvantaged.

With its shiny and new tech solutions, the gig economy was heralded as a revolution for economic opportunity and, to be sure, there have been some freelancers who earn high incomes through creative endeavors. These tend to be a minority, though, and those who need it least.[26] This was not quite so evident in the 2010s, when just under 30 percent of all workers in the United States had an alternative work arrangement as their primary job.[27] Now, according to a recent Gallup Poll, that number is as high as 70 percent.

As more people entered freelance positions in a full- or part-time capacity, workers' rights have been eroded across the board. California's move to protect employees and independent contractors[28] in 2019 was ended with a California Supreme Court loss, which allowed platform companies to continue exempting themselves from providing benefits to their contractors.[29] This has resulted in lack of health insurance, workers' compensation protections, employer contributions to Social Security and payroll taxes, paid time off, family leave protections, discrimination protections, and unemployment insurance benefits.[30] The future solvency of the Social Security Trust Fund has been put at risk as a result, potentially harming all retirees in the long run.

While transportation network company drivers can breathe a sigh of relief that automation has not come to take their jobs as of yet, other companies have been successful in replacing labor with long-available tech solutions. The result: more people entering the freelancer and gig economies, forgoing employee benefits and just making ends meet on contract work. It is a grave byproduct of a down market and predatory monopolies. "Platform companies monetize the desperation of people in the post-crisis economy," says Doug Henwood of the Economic Policy Institute.[31] Young people have sought opportunities through higher education, with many deciding to forego having a family in the down market. Whether they will find good jobs waiting for them when they graduate remains to be seen. ■

May 22, 2037

Calls for Seed Banks to Be Opened to Curb Big Ag Impacts

The American Farm Bureau Federation is making a plea to the U.S. National Plant Germplasm System (NPGS) to access some of its 600,000 different varieties of American seed samples stored in its vast network of seed banks scattered throughout the United States.[32] The NPGS, falling under the auspices of the U.S. Department of Agriculture and funded by Congress, is the primary network that manages publicly held crop seeds and samples in the United States.[33]

The request from the Bureau comes in the wake of one of the largest crop failures since the drought-induced dust storms of the 1930s. Nearly 60 percent of wheat, corn, and potatoes were stricken by blight in this year's harvest, dwarfing the effects of the corn blight of 1970, which ruined more than 15 percent of corn crops in North America.[34]

Food insecurity has reached an all-time high, at 37 percent nationally. Malnutrition is even more ubiquitous, with 95 percent of the national population having some form of vitamin, mineral, or protein deficiency. The upper echelons of society who can afford a balanced diet of nutritionally dense foods are enjoying the fruits of other nations' soils. In 2020, just 15 percent of food was imported to America.[35] Today, it is closer to 40 percent.

"Monoculture is most certainly to blame," says Mike Drano, chair of the National Sustainable Agriculture Coalition organizational council. "The Farm Bill [of 2022] left out important funding typically dedicated to preserving and improving soil and water quality and providing pollinator habitats." Mr. Drano refers to funds from the Conservation Stewardship Program, which was discontinued in 2022.[36] Indeed, high-yield crops dusted with synthetic fertilizers have choked out thousands of other plant species and created a soil environment reminiscent of the Dust Bowl a century ago. And from these barren soils have come small harvests of nutrient-depleted foods.

Tapping into the seed banks, says the Bureau, will help with propagating and revitalizing some of the most devastated farmlands across the Central Plains. Before any replanting is done, however, farmers and landowners must provide evidence of sufficient remediation of nutrients and revival of microorganisms to the extent that soils are once again hospitable. The Bureau is asking NPGS for its help in identifying a diverse array of crop varieties that may help to stabilize soils over time, build a more sustainable food system less reliant on herbicides and fertilizers, and re-establish pollinator habitats.[37] ■

GHG emissions continue climbing—with atmospheric carbon reaching 460 parts per million in 2040, from just over 400 parts per million in 2015—crossing a point of no return toward the worst outcomes of climate change. Heat waves roil the nation each summer. Greater Philadelphia experienced three major brownouts and saw heat-related deaths reach an all-time high in 2045, with low-income populations, the young, and the elderly proving to be especially vulnerable. Genetically modified crops fail in the wake of sudden climate shifts, leading to massive food shortages with bygone staples, such as orange juice, becoming luxury products.

Despite a shift to mileage-based user fees in lieu of a gas tax, funding for infrastructure continues to lag behind investment needs. Many local roads are in increasingly poor condition, while a rapid decline in conditions on the I-95 viaduct in South Philadelphia causes traffic closures due to a lack of funding for reconstruction. More extreme weather events and temperatures limit opportunities for low-emission active transportation. While the majority of Americans enjoy fewer luxuries than their parents once did, the top echelons have rebounded and consolidated their hold on the economy. ■

dvrpc

2040s
DELAYED EXPECTATIONS

March 9, 2041

2040 Census: Greater Philadelphia Population Declines Amid Undercount, Hurricane, & Pandemic Concerns

Recently released U.S. Census data estimates Greater Philadelphia's population on April 1, 2040, was 5,716,206: a 2.2 percent decline over the past decade. Chester and Montgomery counties had the highest growth, while Burlington and Camden had the greatest decreases.

If accurate, the count shows the effects from Hurricane Theresa's devastation and a series of global pandemics. However, the City of Philadelphia has raised concerns of an immigrant undercount, pointing to the addition of a "citizenship" question to the Census as a potential cause. An undercount risks federal funding levels for programs such as the Children's Health Insurance Program and transportation infrastructure, and could cost the commonwealth a congressional seat.

Census data shows that deaths (80,854 per year) outpaced births (60,527 per year) in the region. Tight restrictions have slowed foreign immigration over the last several years. Still, some 60,347 moved into the region each year, while 26,531 moved abroad annually over the last decade. Domestically, 129,416 moved out of the region each year compared to 103,198 moving in. People of color now comprise 42 percent of the region's population, up from 40 percent in 2030. The region's median age is 42.0 years old, and 1.22 million individuals — 21 percent of the population — are older than 65.

Greater Philadelphia remains the country's eighth largest region—trailing the New York City, Los Angeles, Chicago, Dallas-Fort Worth, Houston, Washington, DC, and Atlanta regions. As climate change is making many coastal and southern locations less and less hospitable, the fastest-growing regions continue to shift north and inland. The Denver, Minneapolis-St. Paul, and Detroit regions could all surpass Greater Philadelphia before the next Decennial Census. ■

GREATER PHILADELPHIA DECENNIAL CENSUS POPULATION (IN THOUSANDS)

COUNTY	2010	2020	2030	2040	% Change 2010–2040
BURLINGTON	449	443	438	410	–8.6%
CAMDEN	514	511	511	483	–5.9%
GLOUCESTER	288	289	286	271	–5.9%
MERCER	368	371	374	354	–3.6%
NJ SUBREGION	1,618	1,614	1,609	1,519	–6.1%
BUCKS	625	629	633	650	+4.0%
CHESTER	499	521	530	550	+10.3%
DELAWARE	559	569	575	589	+5.4%
MONTGOMERY	800	831	835	854	+6.8%
PHILADELPHIA	1,526	1,599	1,664	1,553	+1.8%
PA SUBREGION	4,009	4,149	4,237	4,197	+4.7%
GREATER PHILADELPHIA	5,627	5,763	5,846	5,716	+1.6%

SOURCE: DVRPC, 2020.

dvrpc

EXPECTATIONS DELAYED AS CLIMATE CHANGE SOLUTIONS REMAIN OUT OF REACH

May 19, 2044

Not too long ago, there were predictions that all kinds of technologies, from artificial intelligence to driverless cars, were going to solve problems and usher in an era of productivity, safety, sustainability, and convenience. Unfortunately, most of these technologies remain largely in the realm of science fiction today. The United States has pulled out of global climate and trade agreements, shut its doors to immigration, and stepped off the global stage. These geopolitical chess moves have shifted public sentiment but failed to reopen the doors closed off by our widening national divisions. A sampling of recent news headlines reveals what is holding Greater Philadelphia back:

Congress Fails to Meet Due to Lack of a Quorum

Heat-Related Deaths in Philadelphia Reach an All-Time High

With Transportation Funding Stalled, What to Do with the Closed Section of I-95 in South Philly?

Are We Ready for the Next Global Pandemic?

Income Disparity Now Worse than the 1920s

Is King of Prussia Becoming the Region's Economic Center?

Study Finds Low-Income, Minority Populations Most Vulnerable to Climate Change

Return of a Superpower: Russia's Shocking and Disconcerting Ascent

Still a Long Way to Go in Dismantling Systemic Racism

What Can Drive the Economy Forward as Innovation Slows?

On Pace for 3˚C Rise by 2100, Is Geoengineering Our Last Hope?

While seemingly unrelated, these headlines highlight a combination of slow innovation, changing climate, and long-term partisan paralysis. Mother Nature has stepped into the political leadership vacuum and is creating climate and viral outbreak chaos. Even things that used to be bipartisan, like fighting global pandemics and rebuilding after a disaster, have become politically contentious. Federal monetary and fiscal policy remains overly focused on threats like budget deficits and inflation, overlooking critical threats, such as increasing inequality and lack of investment in infrastructure and education.[38] Climate refugees remain blocked at the border, while U.S. regions that have been devastated by natural disasters or stagnant economies—Greater Philadelphia has struggled with both—continue to have a hard time rebuilding due to lack of money and workers. The unusable I-95 viaduct in South Philadelphia remains the most glaring symbol of our paralysis, particularly the inability to move forward on doing anything productive with it.

The region's private sector has struggled as climate change and global pandemics have destroyed considerable capital, while political uncertainty has reduced investment in research and development. Many economists are concerned that corporations are using regulatory capture to limit their responsibility for dealing with climate and public health issues, and big companies are actively limiting innovation in order to restrict competition. Older industries long suggested as being ripe for technological disruption are holding on but struggle to attract skilled workers.

Failure to slow rising sea levels means that population and jobs are quietly moving to higher ground in the southeastern Pennsylvania suburbs or out of the region altogether. Russia is rising on the global stage. It has been best able to weather the chaos generated by disinformation and profit from the sale of natural gas. Warmer weather is also helping it become the breadbasket of the world.[39]

THE LAST SEVERAL DECADES SHOW HOW DIFFICULT IT IS TO EFFECTIVELY CHANGE SOCIETAL INSTITUTIONS, EVEN IN THE FACE OF IMPENDING DISASTER. MOVING BEYOND OUR ONGOING CRISES REQUIRES REAL DIALOGUE ABOUT THE ERASURE OF COMMUNITIES, STRUCTURAL RACISM, AND UNEQUAL DISTRIBUTION OF WEALTH.

The last several decades show how difficult it is to effectively change societal institutions, even in the face of impending disaster. Moving beyond our ongoing crises requires real dialogue about the erasure of communities, structural racism, and unequal distribution of wealth.[40] This engagement is crucial to responding equitably to a changing climate. As avoiding the worst of climate change seems increasingly unlikely, desperate times call for desperate measures. Hence the serious consideration of geoengineering projects to seed the skies with sulfur dioxide aerosols to reflect some solar radiation back into space. This costly project risks bleaching the sky, increasing acid rain, decreasing crop yields, melting the ozone layer, irreparably changing the water cycle, and causing other unforeseen consequences.[41] Unfortunately, this is the lesser of bad options when faced with the prospect of an uninhabitable planet.

As long as economics focuses on efficiency and restricts proactive responses, rather than providing opportunity for everyone and increasing resiliency, the world will remain in this state of arrested development.[42] Breaking out of this cycle requires reforming and better harnessing institutions, markets, and innovation to meet broader societal needs—including equity, resilience, and environmental sustainability—rather than just fulfilling individual desires. ■

The following section provides a glimpse into a possible future—characterized by high levels of political will and collective action, and incremental change in technology—through a series of fictional news articles. None of these articles are seen as optimal or preferred futures for Greater Philadelphia. Rather, they show the opportunities and challenges in how key driving forces may shape the region over the next several decades, and how the decisions we make and our reactions to these forces may shift their implications.

DELAWARE VALLEY
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PEOPLE POWER

Grassroots democracy gives citizens more input into the development of their communities and the economy, while readily available technologies are deployed to fight climate change.

dvrpc

2020s

PEOPLE POWER

The COVID-19 crisis lasts for several years, as a vaccine is slow to be developed and distributed. The delay bolsters the case for universal healthcare and increases the need to act collectively. Black Lives Matter protests and social justice advocates build a multicultural coalition that undertakes difficult and uncomfortable reconciliation talks. This dialogue leads to massive reforms around policing, education, community investment, and efforts to combat systemic racism. Eventually, this coalition helps bring about sweeping new federal legislation, known as the Fair New Deal (FND), which strengthens the social safety net, antitrust measures, and personal privacy. The FND uses existing technologies to reduce GHG emissions and shifts many independent contractors back onto company payrolls—weakening the gig economy.

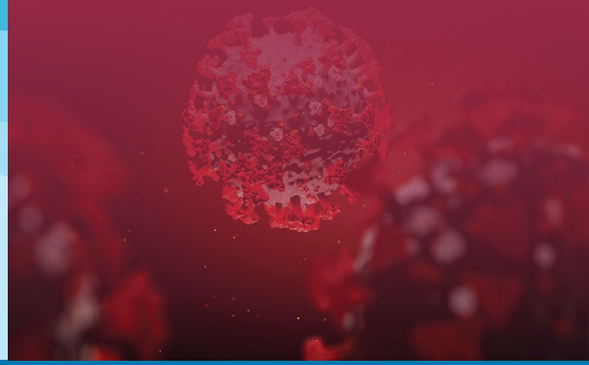
AVs falter in the face of public and safety concerns, and technological shortcomings. In response, the federal government works with private industry to advance connected truck platooning, and with transit agencies to experiment with automated shuttles. ■

March 13, 2024

BREAKING NEWS

COVID-19 Response Last Straw; Universal Healthcare Now

The shortcomings of the COVID-19 response have laid bare the limits of the employer-based, for-profit healthcare system—enough that universal healthcare will be the first major piece of legislation passed in the Fair New Deal. This bill will substantially revise the healthcare industry's fee-for services with a payment-per-patient model that incentivizes keeping people healthy. Senators who co-authored the bill have touted it as the key to preparing for the next pandemic, and for improving treatment and lowering patient costs. Signs of life slowly returning to normal abound—albeit with some unexpected outcomes. It appears the drawn-out crisis has fueled some disillusionment with digital technologies. Delaware County teacher Makayla Holloway offered her perspective, saying, "Once this is over, I don't ever want to look at another screen again."



September 21, 2023

Antitrust Suit Brought against Amazon

As the culmination of a decade of calls for trust busting the next-day delivery giant, a coalition of 23 states and the federal Justice Department has sued Amazon Partners, Inc., in federal court, citing collusion against smaller retailers to stifle and eliminate competition in the marketplace.[43] This follows the 2017 acquisition of Whole Foods Market, and—the straw that broke the fulfillment center worker's back—Walmart in 2022. Although Amazon has acquired hundreds of other firms in the past, some big and many controversial, never before has it bought such an enormous consumer goods outlet, strengthening claims of a deliberate, predatory monopolizing strategy, and certainly not in the midst of the economic chaos levied by a pandemic.[44]

The Justice Department's filing cites violations of the Sherman Antitrust Act of 1890, as well as the Clayton Antitrust Act. But the case is made stronger by the Fair New Deal's (FND's) strengthening of antitrust law. The passage of the FND and the news of this suit is most certainly a sign of today's political climate, marked by collective will and consumer efficacy that were hardly represented in 2015, when Amazon surpassed Walmart as the most valuable retailer in the United States by market capitalization.[45] Today, there is greater appetite for federal regulators to use new and existing tools to unwind anticompetitive mergers.

Rick Brennan, a small vendor and prior third-party seller on Amazon's Marketplace, supports the actions against Amazon. "They killed my business. Just as my sales were up on their platform, they created a similar product and sold it at a price I couldn't match. Now I can't sell that product," says Brennan.

The federal government is expected to pursue the splitting of Amazon's major business units into separate companies, potentially separating the company into different e-commerce, retail, media, electronics and general merchandise, and logistics operations.[46] It will also aim to label the e-commerce platform a common carrier, which would grant equal access to all sellers.[47]

It will be challenging to show that, while Amazon does not fit the classic definition of a monopoly, its position in owning distribution and fulfillment infrastructure, its reach into millions of households with smart home equipment, and data generation throughout every customer interaction from e-commerce to web services, make it all but impossible for new competitors to emerge.[48] The European Union fined Amazon $3.7 billion in early 2023 for using sales data to give itself a leg up over smaller vendors: an issue the probe will look at closely.[49] Representatives from Amazon declined to comment for this article. ■

March 2, 2029

Aging Population Straining Universal Healthcare Programs

Five years after the United States adopted universal healthcare as part of rebuilding the post–COVID-19 economy, researchers are finding early benefits from the expanded coverage. Most notably, chronic diseases like diabetes are being reduced. A decade ago, more than 100 million U.S. adults were living with diabetes or prediabetes, many of them from lower economic strata. From 2013 to 2015, 12.6 percent of adults with less than a high school education had diagnosed diabetes versus 7.2 percent of those with more than a high school education.[50] Today, those rates are 7.2 percent and 5.9 percent, respectively. The benefits do not stop there. Since people with diabetes are at an increased risk of other health complications such as heart disease, this progress is allowing people to live longer, healthier lives.[51]

What this means for the Greater Philadelphia region and the country as a whole is a rapidly aging population. With mortality rates decreasing as a result of preventative treatments and improvements in medical technology, healthcare and other social systems are feeling the strain of a growing population of retirees. Long-stressed Social Security income rates are at a breaking point, and the healthcare system that paved the way for more citizens to enjoy their golden years is facing the prospect of paying for those individuals.

"This problem was a predictable one, but it's a simple fix given the political will to fund the system properly," says Sharon Levigne, program director at Wharton's PhD program in Health Care Management and Economics. "As the population ages and outspends the program's revenue sources from payroll taxes, contribution rates need to increase."[52] Despite a 70 percent approval rating of the universal healthcare system, calls to bolster its funds in the form of taxes have been met with opposition, begging the question of who will bear the cost of the growing senior and geriatric population. Taken a step further, many are asking whether increased life expectancy is the right goal, and how sustainable—or not—it might be.

Still, investments in public transit and paratransit have been helpful in ameliorating socioeconomic differences in healthcare access. These services are a lifeline, especially as long-available services, such as transportation networking companies, faltered in the face of Fair New Deal worker protections. Until legislation can be passed to ensure the longevity of a system so hard fought for, basic public transportation services are a welcome reprieve. ■

October 17, 2029

Federal Officials Investigate Truck Platoon-Related Crash on PA Turnpike

Federal officials are investigating a fatal crash on the Pennsylvania Turnpike near Valley Forge, in which a vehicle struck an off-ramp divider. The presence of a truck platoon—a group of connected trucks traveling in a convoy with a lead driver—in the immediate vicinity at the time of the crash has triggered a U.S. Department of Transportation (USDOT) automated vehicle (AV) crash investigation, as mandated under the 2025 Safe Connected and Automated Trucks and Vehicles (SCATV) Act. Witnesses at the scene pointed to the driver's attempt to overtake a truck platoon in order to reach the exit as a likely cause of the incident. The crash is renewing calls for Harrisburg to revisit recent state legislation permitting up to four-truck platoons on Pennsylvania highways.

The SCATV Act's creators made a strategic decision to focus on freight automation before approving the technology's use for personal vehicles due to public safety concerns. A major driver behind the SCATV Act was the exponential rise of e-commerce, resulting in ever-increasing demand for truck delivery, which continues to strain the nation's roadways. There would be even more trucks on the road if there were enough drivers for them. The trucking industry, in partnership with the federal government and many state governments, continues to push platoons as an immediate option to combat the shortage of truck drivers, while hoping that full self-driving automated trucks will be a long-term solution.

The SCATV Act sets tough standards for AV safety and performance, which must be satisfied before granting any commercial licensing. "We believe that these regulations will help to achieve the vision for a safe, equitable, and low-carbon transportation network," said Natalie Whiteside, a spokesperson for USDOT. Nevertheless, critics contend this regulation-heavy approach is slowing down potentially life-saving technologies.

Commercial truck platoons have become a routine sight on the nation's highways since the passage of the SCATV Act. This Act provides federal grants to develop automated truck ports near highway entrance and exit ramps to transfer between highway-based platoons and human-driven trucks.[53]

Many states have begun increasing the allowable number of trucks that can join into a platoon. Critics contend that allowing longer platoons will increase the number of traffic incidents like the one yesterday. Even as vehicle safety advances, evolving vehicle capabilities and behaviors produce new safety challenges. This crash further illustrates why USDOT's slow rollout of spaces for automated trucks and low-speed shuttles may not be a bad thing. ■

CREDIT: USDOT FHWA

2030s

PEOPLE POWER

The FND aimed to reduce VMT and double fleetwide average fuel economy for all cars and light trucks by 2035 as key ways to reduce GHG emissions. This, combined with transit investments, helps stimulate redevelopment in both urban and suburban locations to build more walkable communities. The region's transportation network is increasingly multimodal, even as private-market interest in shared mobility services wanes. While TNCs have been in decline, there has been growth in small, shared, rideable modes such as bikesharing, e-bikes, and e-scooters, which are generally operated by public or non-profit organizations.

As concerns mount in the wake of increased precipitation, governments and insurance companies no longer support redevelopment in floodplains and focus instead on high-and-dry infrastructure. Subsidies for green building practices have given way to strong market demand for resource efficiency, occupant health, and waste reduction in residential and commercial development. On-site renewable solar, wind, and geothermal energy production are now applied in most new construction, and energy is being decentralized in older buildings as well. Most corporations are reincorporating as benefit corporations or worker-owned cooperatives, in response to growing consumer and worker demand for more sustainable and worker-friendly business practices. ■

dvrpc

November 20, 2035

Extreme Weather Tipping Point for Decentralized Energy

This week, PECO became the third major public utility company in the United States to decentralize its energy platform for existing residential and commercial buildings. Following a decade of disruptive power outages caused by increasingly intense storm events, Exelon Company has presented a five-year plan for implementing Decentralized Renewable Energy (DRE) through the use of microgrids, picogrids, solar lanterns, and solar-powered unit boxes to its entire service area.[54]

Leading the charge has been Pacific Gas & Electric, which became the first utility to provide DRE in 2026 in response to its losing battle against drought-induced forest fires and its ensuing reorganization. Con Edison, serving New York City and Westchester County, New York, followed, citing blackouts and brownouts as a primary catalyst for its transition.

PECO has been setting the stage for this shift for some time now. Expanding its green building subsidies over the last decade, the Exelon company has been supporting off-grid energy distribution for new development since 2030. Its latest program expands this service to existing development, largely via modular solar home systems and bidirectional electricity meters that enable peer-to-peer electricity trading.[55]

While PECO is on the front end of decentralization, this shift is representative of a larger national trend of power and utility companies responding to strong market demands for resource efficiency, occupant health, and waste reduction in residential and commercial development. The pivot not only opens new revenue opportunities in a highly digitized energy ecosystem, but also solidifies existing companies' roles as central players, hedging against their replacement by direct-to-consumer apps and services.[56]

In addition to utility subsidies, homeowners can take advantage of federal tax incentives to underwrite the installation of DRE equipment. By taking a lead on climate change and resiliency efforts in this way, the United States is positioning itself to become the market leader in clean energy technology. ■

June 12, 2037

Supreme Court Invalidates Single-Family Zoning

The Supreme Court has responded to decades of housing activism with a decisive 6-3 ruling in *Just Housing Advocates against Marin County, CA*: a landmark case that will outlaw single-family zoning.

Zoning has been used to guide the development of our communities for more than a century, with few changes to basic structure. As noted by Veronica Logan, a professor of urban studies and geography at Rutgers University, "As urban population has continued to rise, demand for housing in economically successful regions has long since outstripped supply. The result has been fast-rising rents, generations of families and unrelated individuals sharing housing, and pressures to 'upzone' and allow more units to be built in areas experiencing high demand."

While some cities, such as Minneapolis, Minnesota, and states, such as Oregon, were successful in nullifying single-family zoning over the last two decades, the housing crisis has continued in many parts of the country. After several failed lawsuits in Marin County, California; Westchester County, New York; Montgomery County, Maryland; and Montgomery County, Pennsylvania, lawyers teamed up to bring a class-action suit against single-family zoning on a national level.

In the case of *Just Housing Advocates against Marin County, CA*, plaintiffs cited examples of discrimination; exclusionary practices causing racial and economic segregation; and long-term negative health effects resulting from the lack of safe, adequate, and well-located housing to most Americans.[57]

In his concurring opinion, conservative Justice Marcus Alderman supported the majority by citing the economic inefficiency of low-density, single-family housing, as well as how failing to build affordable housing in wealthy areas of the United States can hinder the nation's economic growth by shifting development to less beneficial locations or regions without the jobs, infrastructure, or institutions to support it.[58]

Real estate and environmental stakeholders and activists applauded this decision. Indeed, the ruling is likely to create more construction jobs for the real estate industry, and to limit the negative impacts of leapfrog development into highly valuable agricultural land and open space that would require the extension of public utilities and infrastructure.

The court's ruling gives local governments a one-year moratorium to write single-family codes out of their zoning ordinances. Many forward-thinking governments have already been doing this through form-based codes, inclusionary zoning mandates, and other techniques. Those behind the curve will need to allow for every residential lot to house accessory dwelling units or duplexes at a minimum. ■

April 9, 2038

Transit Renaissance Continues as SEPTA Regional Rail Returns to West Chester

Transit service is flourishing around Greater Philadelphia as regional rail service returns to West Chester, Pennsylvania, for the first time since 1986. It is the latest in a string of major capital projects made possible by the funding provided by the Fair New Deal and dedicated local funding sources created soon after its adoption. The expansions have led to a surge in ridership, which has risen nearly 40 percent in Greater Philadelphia over the past 20 years.

The new funding was made possible by replacing the gas tax with commercial property fees based on vehicle miles traveled (VMT) generation, as well as a tradable driving credit system. In the latter, each person receives an annual allotment of VMT credits. Individuals who drive less can sell unused credits, while those who drive more must either purchase credits through the trading marketplace or pay an overage fee.

Increasing local transportation revenue was critical to matching the higher levels of federal funds available. Local funding was basically non-existent before the creation of the Southeast Pennsylvania Regional Transportation Authority (SPARTA), which collects and distributes tax revenues to the Pennsylvania Department of Transportation, the Southeastern Pennsylvania Transportation Authority (SEPTA), and local agencies. The agreement to create SPARTA set an agreed-upon revenue contribution level from each southeastern Pennsylvania county and then gave each county a menu of tax options for generating it.

The results of these investments have been astounding: the King of Prussia Spur, a 22nd and Market Station, Market-Frankford Line frequency improvements, the Glassboro-Camden Line, and South Jersey Bus Rapid Transit Line. They have also helped incorporate technology to enhance transit. The region's first automated shuttle route runs along Philadelphia's Chestnut Street pedestrian mall. Its success has officials considering more pedestrian zones along main streets in communities throughout the region. In suburban areas, automated shuttles increasingly serve to get people to and from regional rail stations. As Philadelphia's Deputy Mayor for Transportation Adele Lewis stated, "Without the SPARTA's local matching funds, the region would have lost out on a considerable amount of federal funds, and few, if any, of these projects would have been built."

Armed with success stories, and the finances to support further expansion, the region's transit agencies are strategically planning their next steps. "Most of our foreseeable big-ticket projects will focus on improving our core network, making extensions to existing rail lines, and upgrading bus routes," said Taliyah Mackey, SEPTA's Director of Strategic Initiatives. Mackey says the agency is also working to facilitate easier transfers between modes and to better fill transit service gaps. ■

By 2040, GHG emissions have declined by nearly 60 percent per annum, thanks to tax subsidies for electric vehicles, carbon capture and storage technologies, increased vehicle fuel efficiency, open space preservation, conservation tillage techniques in agriculture, and a variety of other tools supported by the FND. Despite this, atmospheric carbon stands at 435 parts per million; dangerously close to the 450 parts per million limit if the worst outcomes from climate change are to be avoided. Climate change is causing significant challenges in the region. In response, seawalls are being built all along the Jersey Shore, as well as within the Navy Yard and Philadelphia International Airport, to reduce nuisance flooding and its considerable economic and environmental costs. Fears of automation and robotics overtaking huge swaths of the workforce have proven to be hyperbolic. Jobs are increasing in healthcare, real estate, infrastructure development, technology, social media, artisanal services, logistics, and other industries. People are living longer, but this creates major challenges for the jobs market, healthcare, and retirement plans. ■

dvrpc

2040s

PEOPLE POWER

March 9, 2041

2040 Census: Greater Philadelphia Still Growing Slowly

Greater Philadelphia's population on April 1, 2040, stood at an estimated 5,909,859, according to recently released U.S. Census data. The region's population has risen by 138,900 people over the past decade, a 2.4 percent increase from 2030, marking the 26th Decennial Census that has seen a population increase within the region.

Growth has been evenly spread throughout Greater Philadelphia over the past 10 years. The region's planning is increasingly directing growth around transit-oriented and walkable communities, and increased land protection has slowed suburban sprawl.

While annual deaths (71,100) continue to outpace births (65,000), an expanded social safety net for child support means birth rates are rising. Better access to healthcare is also enabling people to live longer. Foreign migration continues to drive growth: 825,600 people immigrated to the region since 2030, while 351,700 residents moved out. Domestic population continues to move elsewhere, with 1.03 million moving in, while 1.41 million moved out.

The number of people of color increased by 14 percent over the last decade and now comprise 46 percent of the region's population. The region's median age is now 41.4 years old. The population under age 16 decreased by 2 percent between 2030 and 2040, with just over one million residents in this age range. Growth in the over-65 segment continues to surge, having increased by 7 percent over the past 10 years. There are now 1.21 million residents over age 65 in the region.

The Greater Philadelphia region is now the 10th-largest in the country—trailing the New York, Los Angeles, Chicago, Dallas-Fort Worth, Houston, Washington, DC, Miami, Atlanta, and Phoenix regions. ■

GREATER PHILADELPHIA DECENNIAL CENSUS POPULATION (IN THOUSANDS)

COUNTY	2010	2020	2030	2040	% Change 2010–2040
BURLINGTON	449	443	446	462	+3.0%
CAMDEN	514	508	515	526	+2.4%
GLOUCESTER	288	288	290	304	+5.5%
MERCER	368	371	377	385	+4.7%
NJ SUBREGION	1,618	1,610	1,629	1,677	+3.6%
BUCKS	625	622	610	621	–0.7%
CHESTER	499	516	509	528	+5.8%
DELAWARE	559	563	553	563	+0.8%
MONTGOMERY	800	823	805	820	+2.5%
PHILADELPHIA	1,526	1,603	1,665	1,701	+11.5%
PA SUBREGION	4,009	4,127	4,142	4,233	+5.6%
GREATER PHILADELPHIA	5,627	5,737	5,772	5,910	+5.0%

SOURCE: DVRPC, 2020.

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COMMUNITY ORGANIZATION GIVES PEOPLE POWER

March 15, 2044

Philadelphia resident Xialing Li served as a regional communications director for the federal government during the development of the Fair New Deal (FND). In light of its 20th anniversary, Mrs. Li sat down to talk with us about the legacy of this landmark legislation.

Tell us about the context in which the FND was developed.

XL: The country was desperate for change in light of the COVID-19 pandemic, George Floyd/ Black Lives Matter protests, as well as concerns over inequality, climate change, and potential technological disruption. We wanted to let people figure out how to address these challenges at the local level. Ultimately, the FND was about community organizing to bring people together.

What are some ways in which the FND brought people together?

XL: The key was the federal government's willingness to really listen to people and give them a voice in the political decision-making process. We had a lot of difficult and honest conversations around systemic racism, social justice, and reconciliation; and how the rules of the game, economic and otherwise, really shape outcomes. This powerful shift arose from recognizing technology, globalization, and changing demographics weren't causing income inequality to the same extent in other developed countries. Inequality and climate change were the result of how we were structuring institutions and the rules governing markets and our economy.[59]

And rewrite the rules you did. What do you think was the most difficult part of this process?

XL: You mean besides the fierce political opposition? I'd say we had some really hard

conversations with communities relating to rising levels of inequality, and thinking about how to respond in a proactive fashion.

What do you think was the greatest success of the FND?

XL: I'd say the fact that it continues to bring down greenhouse gas emissions. We envisioned this effort as a type of Manhattan Project that would quickly deploy proven technologies to improve energy efficiency or conservation. This meant updating tax codes, regulations, and how the government operates and invests in projects—and not just the federal government. We wanted to find ways to make state and local governments more efficient as well. We set a goal to avoid overly burdening disadvantaged groups and communities. While not everything went perfectly, we have largely succeeded in sending a helping hand to the communities most in need and charted a course to stave off some of the worst outcomes of climate change.

What are some of the ways the FND has most impacted life here in Greater Philadelphia?

XL: We passed universal healthcare coverage, which is critical as our population continues to age, and reformed education to make learning more collaborative and community focused. We improved personal privacy protections, which stopped the ability of private actors from tracking your every move.

Those are huge advances, but didn't it largely start out as environmental protection legislation?

XL: It did. The FND helped to build the decentralized electricity grids that have brought down electricity costs and increased resiliency when we do have a major climate event, whether it be a major rainstorm or heat wave. This region also has a long history of being a leader in land preservation. Greater Philadelphia recently topped one million acres of permanently preserved open space and farmland, and the FND helped to fund a lot of these efforts.

Beyond the environment, it contained workforce protections that made it harder to reclassify workers as independent contractors. More paid time off gives people the opportunity to enjoy their lives and spend time with their family. This is critical as the current generation of adults may be caring for parents, grandparents, and kids all at once.

What would you say to those who are still critical of the FND, particularly those concerned that it has forced austerity onto the nation and reduced its ingenuity?

XL: The FND was developed in an open, transparent, and inclusive process. One that ultimately recognized we would have to find ways to consume less, if we were going to really move the needle on climate change. It set up ways in which people were rewarded when they did consume less in a way that was fair to everyone. Ultimately, we made some tough decisions, but most people I talk to feel we are in a better place than we were 20 years ago. People of all backgrounds and concerns shaped this process and were given a more prominent voice in what kind of community they want to create.

Xialing, thank you again so much for speaking with us. Would you like to add anything else?

XL: Thank you as well. I'd add that tackling big problems, such as climate change and inequality, take a long time. That is why it's critical to think and plan long term, and undertake comprehensive approaches. There is still a lot of work to be done; the climate crisis isn't over, and there are still people being left behind even in today's economy, plus all kinds of new challenges on the horizon. Fortunately, a new generation of activists is out there ready to confront these issues head on. ■

DELAWARE VALLEY
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REGIONAL
PLANNING COMMISSION

The following section provides a glimpse into a possible future—characterized by high deference to market forces and reliance on individual responsibility, and transformative change in technology—through a series of fictional news articles. None of these articles are seen as optimal or preferred futures for Greater Philadelphia. Rather, they show the opportunities and challenges in how key driving forces may shape the region over the next several decades, and how the decisions we make and our reactions to these forces may shift their implications.

TECHNOLOGY IN THE DRIVER'S SEAT

Markets drive economic growth through Big Data, algorithms, and innovation.

dvrpc

2020s

TECHNOLOGY IN THE DRIVER'S SEAT

The COVID-19 outbreak leads to increased investment in biotech research, which yields major healthcare advances. It also strengthens the Big Tech companies, who control proprietary video conferencing, remote working software, and holograms. As public health surveillance gains acceptance, tech giants increase their personal data collection and targeted advertising.[60] The crisis propels automation, AI, and other disruptive technologies, which catapult the global economy into a new era of industry and post-pandemic progress.

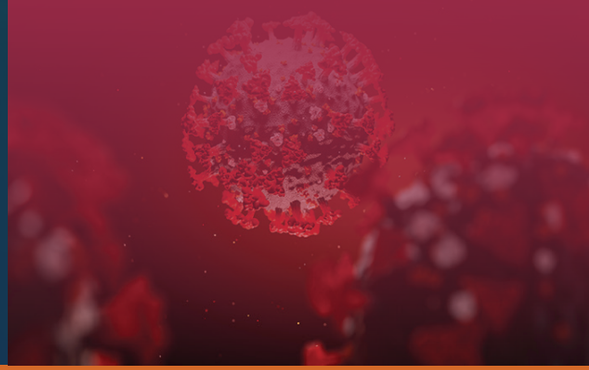
Big Tech companies use their political clout to end net neutrality, allowing internet providers to wall off information and services.[61] "Buyer, beware" approaches to regulation mean all kinds of questionable products are readily available for consumption. Fossil fuel companies increase their research and development in the areas of renewable energy generation and carbon capture to protect their business interests, even though the climate has been surprisingly stable. This allows those who deny climate change to promote business-as-usual practices. ■

September 17, 2022

BREAKING NEWS

COVID-19 Resurges Again, Despite Vaccine

COVID-19 is on the rise in parts of Africa, Asia, and the Middle East once again, as the coronavirus vaccine remains out of reach for many in developing nations. Developed by U.S. pharmaceutical firm Merck in early 2021, nearly 70 percent of the U.S. population was vaccinated within a year thanks to a public-private partnership between Merck, the Centers for Disease Control, and Google Cloud. Beyond enabling the vaccine's distribution, this partnership has become the largest ever health data aggregation project. It also ended investigations into the tech giant's privacy and data protection breaches in several healthcare projects that predated the 2019 outbreak. But the time to manufacture billions of vaccine doses, the lack of a similar global partnership to widely distribute it, and its high cost means many of the world's poorest and most vulnerable populations are still waiting to be vaccinated.



February 27, 2023

Ready or Not, the Automated Vehicle Race Arrives in Philly Area

China's DrivePower is the latest company to make highly autonomous vehicles (HAVs) available to consumers. These HAVs can operate only in specific areas, such as limited-access highways and some major arterials, and in good weather conditions. While some manufacturers promise full HAVs that can go anywhere in any condition within a few years; others cautiously warn that this may take decades due to the need for advances in computing power and artificial intelligence.

The race to deploy HAVs began to heat up with the passage of the ROBOTIC DRIVING Act of 2022, aimed at speeding up HAV deployment in the wake of the COVID-19 pandemic. This legislation removed all vehicle safety regulations for HAVs and directed the National Highway Traffic Safety Administration (NHTSA) to create a new regulatory structure for them, limited the ability of state and local governments to restrict HAVs on their roadways, granted states the right to apply congestion pricing on interstates and other highways, and required manufacturers to develop plans for collecting data while ensuring privacy, and communicating this to consumers.

While DrivePower faces stiff competition, bigger questions remain about what this means for Greater Philadelphia's fast-changing transportation system. The public has had little opportunity to weigh in on their wants and needs for these vehicles, or to help shape the newly emerging transportation system.

"I'm still not comfortable with them," said Southampton Township, New Jersey, resident Barbara Spencer. "I saw one going south on 206 last week. Its backup driver wasn't paying any attention. It stopped at first, but then when I started to cross the street, it started going as well. Fortunately, it stopped before hitting me. How is a person supposed to communicate with these cars?"

The first fatal crash between two actively self-driving vehicles has heightened safety concerns. While investigators are still looking into its causes, it has been speculated that it may be the result of sensor failure, the difficulty of reading and predicting different operating systems, or a software bug.

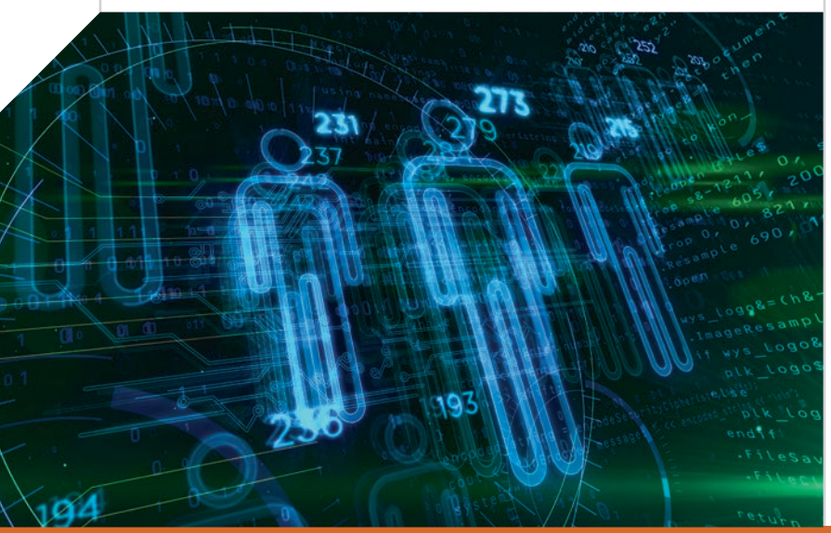
Roadway Auto and Safety Advocates President Robyn Caroline notes these vehicles were tested on roads with human drivers but rarely with other HAVs. It is difficult to verify this, since few of the manufacturers are sharing data, and there are no regulations that compel them to. NHTSA spokesperson Joe King disputes claims that the agency's voluntary reporting standards are insufficient. "This technology will save tens of thousands of lives each year. We shouldn't put up hurdles that slow that kind of progress down." Despite safety concerns and high prices, HAVs continue to fly off car dealer lots. ■

July 23, 2024

Digital Lives Not so Democratic after All

As social distancing remains the norm, even post–COVID-19, it has become nearly impossible to conduct one's life without a smartphone for everyday transactions. Everything from cashless retailers, to home mortgage lenders, to job applications require a digital profile; it is the new credit. But living in the digital age is a double-edged sword. Behind the scenes, algorithms are increasingly being used to more efficiently make all kinds of critical decisions—from prison sentences to college admissions to loans—that shape individual lives, often without most people even realizing it. While algorithmic decision making at its best can reduce corruption, cronyism, and human prejudice, human-coded models are often biased and may encode prejudices and reinforce socioeconomic divides.[62]

This is an increasingly common situation for employees and insurance applicants whose medical data is tracked by wearables. Biometric data such as heart rate, steps, and even sleep apnea is collected and stored by tech companies and may be shared with third parties without an individual's consent or knowledge. The result could be discounts on premiums on the one hand, or grounds for denial or sky-high prices on the other.[63]



Many corporations are issuing speedy and severe punishments within the confines of their own company. Last year, some 12,000 homeowners in southeastern Pennsylvania alone were locked out of their homes by digital security systems owned by their mortgage lenders after falling into delinquency on their payments. Many times, the fine print of these contracts stipulates that any property inside the home belongs to the lender until payments are made.[64] The problem extends to private transportation services, like Uber bus and rail, and communications, like WhatsApp and Facebook Messenger.

"It's technocracy, gamified,"[65] says Steve Waldman, owner of MyData Security Firm. "The concern isn't that people are being held accountable; it's that sentences are being issued outside the established legal system." Many of the decisions to remove someone from their home or a private service are not made by people but by algorithms. "There's an opportunity to improve those algorithms and make them and the data they use more transparent," says Waldman.[66] The Free Our Data movement has been pushing for just that, arguing that there needs to be more recognition that writing an algorithm is ultimately a political act, but it has hardly moved the needle thus far.[67] Barring regulatory interventions from federal or state governments, the next few years may see more law enforcement determined less by the Constitution and legal code, and more by end-user license agreements.[68] ■

October 4, 2029

Eco-Suburban Housing Markets Are Heating up, but Are They Sustainable?

Long eschewed as unsustainable, low-density suburbs are getting an ec-over, and a new green marketing campaign, thanks to solar power and electric vehicles.[69] A mix of long-available and new technologies is driving developers to claim new parcels and subdivisions. "We're seeing a rise in permits for quarter-acre-lot or larger properties where there is plenty of space for a household to capture and generate solar power and net energy production," says West Caln, Pennsylvania Township Manager Joe Beuhler.

In addition to marketing their net-zero potential, developers and real estate agents point out the automated greenhouses that enable these households to grow much of their own food. The greenhouses take up as much space as a two-car garage, adding to the land requirements. Despite the green marketing, these houses are eating up a lot of former open space and farmland. This raises questions about how sustainable these suburban and greenfield development patterns really are.

Drexel University energy policy researcher Mindy McKenna argues that, "with clean energy, overall consumption rates matter less." Others may disagree. A recently updated UK Committee on Climate Change report notes that battery, solar panel, and wind turbine production all remain energy and resource intensive. The production of all these things requires considerable copper, dysprosium, high-purity silicon, indium, tellurium, and gallium,[70] none of which exist in quantities large enough to provide everyone in the world with a low-density, suburban house powered by solar panels with battery storage and multiple electric vehicles. Instead, many champion dense urban living as an efficient way to reduce energy needs. Row homes and apartments share walls, which limits heat loss. Urban destinations are also in closer proximity to one another, making trips shorter and allowing alternative transportation options.

But many wealthy Generation Z young adults are looking to escape the urban confines their Millennial predecessors sought out. And while they often embrace technology, they have an obvious desire for more privacy. A recent Pew Charitable Trust Survey found that 19 percent of former urbanites were somewhat or very concerned about their movements being tracked, the ubiquity of facial recognition technologies, and/or the amount of surface area in the city covered with digital screens.

With these trends, new subdivisions are once again springing up seemingly overnight and selling out in a hurry. As the allure of the suburbs draws new settlements, sustainable development will be of utmost importance if we are to hit greenhouse gas emissions reduction targets. ■

2030s

TECHNOLOGY IN THE DRIVER'S SEAT

Renewable energy units are rapidly spreading across the nation, but some fear it is too late for GHG reduction to circumvent climate change. There are concerns that renewable energy is being built in a centralized manner that benefits large power companies while creating more risks for brownouts and blackouts. The normal weather of the 2020s looks, in hindsight, like the calm before the storm. As impacts intensify, insurance companies play a bigger role in property development. Housing prices skyrocket, particularly in higher, less flood-prone areas.

Governments missed the window to deploy CV technologies, and HAVs operate independently with little communication between vehicles. The private market's role in governing grows through smart cities and algorithmic decision making. Social justice activists are concerned about biases hidden in data, algorithms, AI, facial recognition systems, and other technologies—which risk public policy gains made in the aftermath of the Black Lives Matter protests. ■

dvrpc

June 25, 2034

The Impacts of Congestion Pricing One Decade In

Laws allowing congestion pricing on public roads were passed in 2022 despite strong public opposition. Yet, just a few years later, support for congestion pricing went from 31 percent to 46 percent according to Franklin & Marshall polling. This corresponded with a 10 percent decline in vehicle miles traveled (VMT) in the first year, leading to a 40 percent decrease in congestion. "It's amazing what getting just a fraction of cars off the road during peak period does for traffic flow," Federal Highway Administration Program Manager Suzanne Coreia said at the time. The increased popularity suggests that many drivers found the costs worth paying.

Traffic rebounded quickly once the economy reopened post–COVID-19 and was met with congestion pricing in Greater Philadelphia in 2024. Variable tolls were initially set between $0.05 and $0.30 per mile, depending on traffic volume and time of day. Some early opponents were unlikely beneficiaries. Reduced congestion, increased reliability, and improved road conditions helped the trucking industry in making on-time deliveries with reduced labor and vehicle operating costs. Center City merchants have also seen more customer traffic, not less, thanks to better travel conditions.[71]

Congestion pricing was sold as a way to shore up the nation's deteriorating roadway and transit networks, particularly as the gas tax was failing to meet the nation's changing transportation infrastructure needs. In practice, however, congestion pricing has been used to signal where additional road capacity is needed and then to fund that expansion. In addition, the need to adapt roads for highly automated vehicles (HAVs) has left less funding for other modes, limiting the availability of much-needed alternatives to high peak-hour congestion prices.

Investment focus on high-volume facilities has also come at the expense of local, lower-volume roads. Poor conditions on these roads have subsequently caused HAV sensors to become misaligned or even to fail. Lobbying for the privatization of high-volume, potentially profitable roads is on the rise. Cash-starved state and local governments are exploring this option but remain wary of losing public revenues and potentially unfairly burdening low-income residents.

While congestion and VMT quickly declined in the first year of pricing, they have been slowly climbing in the years since. The political opposition to raising the maximum peak-hour cap has made driving more affordable relative to inflation every year. At the same time, the increase in electric vehicles has lowered vehicle operating costs, also lessening the impact of congestion pricing. The last decade has shown that markets are the best tool available for reducing congestion, but only if tolls can be increased as needed to shape demand. ■

November 3, 2035

Ubiquitous Cryptocurrency Undermining the U.S. Dollar

More than a decade since the last economic recession, markets are coming to a head with the question that has loomed over cryptocurrency since its swooping takeover of the U.S. banking industry: Will the Dollar survive? The early 2020s Debt Bubble recession, fueled by COVID-19, triggered a flood of government stimulus. This, paired with limited product availability, resulted in high inflation, which caused many to turn to crypto, touting its open, low-cost, and secure access to the financial ecosystem.[72]

But while market volatility proved fatal for Bitcoin, a few select companies were able to insert themselves into the general public's daily lives—and purchases—with the backing of a reserve of real assets.[73] Facebook's Libra, governed by the Libra Association, was one such crypto that everyday people—not just speculators—started using to buy goods and services. Where other cryptocurrencies failed to persuade consumers to actively use their cryptos to buy things, Facebook's omnipresence via its social media platform to 1.7 billion daily users made its blockchain wallet, Calibra, an easy transition.

To be sure, there have been positive effects as a result of a global currency and financial infrastructure that is free to access. Hundreds of millions of people previously without bank accounts now have access to crypto accounts, and the seamless transfer of funds has created enormous economic efficiencies.[74] And unlike Bitcoin, which was decentralized and difficult to track, the Libra has actually made it easier for law enforcement to track tax evasion and illegal trade.[75]

However, as the cryptocurrency market continues to grow and expand, it undermines the sovereignty of governmental monetary policies. Where the Federal Reserve has controlled the circulation of money in the United States for over a century, its ability to manage inflation and stimulate economic growth is eroded with every blockchain transaction. The once almighty dollar has continued to depreciate due to the wide adoption of Libra in the United States and abroad. Indeed, the size of Facebook's network—that which made its widespread adoption so seamless—made it so devastating to the U.S. dollar. And locating its headquarters in Switzerland put Calibra further out of reach for the federal government's taxation and regulatory authority.

In a last-ditch effort, the House, on Tuesday, passed a bill authorizing a Fed-issued digital currency. But the role of the U.S. dollar, whether market-based or by government fiat, as the world standard may have been reassigned to another central agent altogether. ■

August 24, 2037

American Bumblebee Officially Extinct

Bombus pensylvanicus, the American bumblebee, has joined some 1,200 other bee species native to North America in receiving a designation from which they will not return: Extinct. This furry, iconic pollinator, once commonly seen buzzing around gardens and fence posts, is a symbol of the biodiversity crisis facing not just North America, but also the entire global ecosystem.

The International Union for Conservation of Nature released a report earlier this week naming the American bumblebee among the hundreds of insect species recently added to its "Extinct in the Wild" list, indicating survival only in captivity, cultivation, and/or outside its native range."[76] But while the loss of this tiny pollinator is having a big impact on the survival of native plant species and propagation of cultured food sources alike, it is a drop in the bucket compared with the overall impact of pollinator extinction globally.

Pollinators like the American bumblebee are integral to the propagation and species survival of wild and cultivated plants alike, and their disappearance is already having drastic effects on wild ecosystems and food production. Thirty species of orchids, once pollinated exclusively by bees, are now grown only with human intervention.[77] Wild populations of the bumblebee's predators, such as badgers and shrikes, have also been declining over the last several years and are having their own effects on native food webs.[78] In food production, crops such as tomatoes must now be pollinated via ag-drones or robotic systems in vertical gardens. The collapse of bee populations may be our own canary in the coal mine.

The mass extinction of bees and other pollinators has long been attributed to agricultural use of herbicides and insecticides, in addition to habitat loss, pests and diseases, and lack of nutrition resulting from crop monocultures and more areas having a limited number of flowering species.[79] Colonies often contain trace residues from hundreds of pesticides, each of which is benign on its own but can become toxic when mixed together.[80]

These trends have necessitated a shift in farming to more controlled environments as natural pollinators disappear from farms. Vertical agriculture operations have shown themselves to be a more sustainable and eco-friendly option to food production, having lower emissions, higher-nutrient produce, and reduced water usage and runoff than their traditional farming counterparts.[81] This industry shift will, perhaps, be the savior of remaining insects, plants, and animals, which will hopefully experience a resurgence in the absence of the chemicals and land uses that have threatened their populations with extinction. ■

A handful of multinational firms use technology and intellectual property to maintain control over a hotter and wetter planet, which is on a path to warming >2°C by 2100. Automation, robotics, and AI have displaced many workforce tasks and pushed tens of millions of workers into the gig economy. UBI now makes up for gaps in pay. Despite this, there is a sharper contrast between haves—who control the algorithms and data that largely define daily life—and have-nots than ever before. Concerns of every movement being tracked, ubiquitous facial recognition technologies, and an increasing coverage of digital screens is reducing the desirability of urban places and, more generally, reducing social cohesion. Isolation is on the rise, as many turn away from the public realm, while marriage and birth rates decline. Healthcare is focusing more and more on upgrading the healthy and wealthy, rather than healing the sick.[82]

Private shared mobility services offer a variety of modes but operate through monthly contracts that lock users into a single service provider rather than working together as an integrated fleet. These companies often offer automated shuttle services that cut into public transit ridership while helping total shared ridership increase. ■

dvrpc

2040s

TECHNOLOGY IN THE DRIVER'S SEAT

March 9, 2041

2040 Census: Greater Philadelphia Growth Shifts to the Suburbs

Recently released data from the U.S. Census Bureau indicates that Greater Philadelphia's population was 6,106,189 on April 1, 2040. The region's population rose by more than 395,000 people over the past decade, a 7.5 percent increase.

A strong regional economy has propelled growth, as jobs increased by 3.4 percent over the past decade. Every suburban county grew, led by Chester and Montgomery, reversing two decades of recentralization. However, the city's population decreased by 0.7 percent. This is a major shift from the 2030 Census, which had strong growth in Philadelphia, and declines in suburban counties as the region lost 7,000 people overall. Experts say the digital technologies that were centralizing population and job growth have reversed course as highly automated vehicles (HAVs) become more commonplace.

The region has averaged 61,700 births and 74,400 deaths each year since 2030. Domestically, an average of 22,000 more residents came into the region each year than left (156,000 versus 134,000). In the last decade, 631,500 people immigrated to the region, while 330,800 moved abroad.

The number of people of color increased by 10 percent since 2030, and makes up 43 percent of the region's population. The region's median age is now 41.9 years old. The population under age 16 increased by 2 percent over the last decade, with 970,000 in this age range. Growth in the over-65 segment continues to surge, having increased by more than 13 percent over the past 10 years. There are now nearly 1.28 million residents over age 65 in the region.

Even as digital technologies are decentralizing development patterns, they continue to build economies of scale that concentrate economic growth into a handful of tech hubs and large regions around the country. This has helped propel the San Francisco and Seattle regions past Greater Philadelphia in total population. The region is now the 12th largest in the country—also trailing the New York, Los Angeles, Chicago, Dallas-Fort Worth, Houston, Washington, DC, Miami, Atlanta, and Phoenix regions. ■

GREATER PHILADELPHIA DECENNIAL CENSUS POPULATION (IN THOUSANDS)

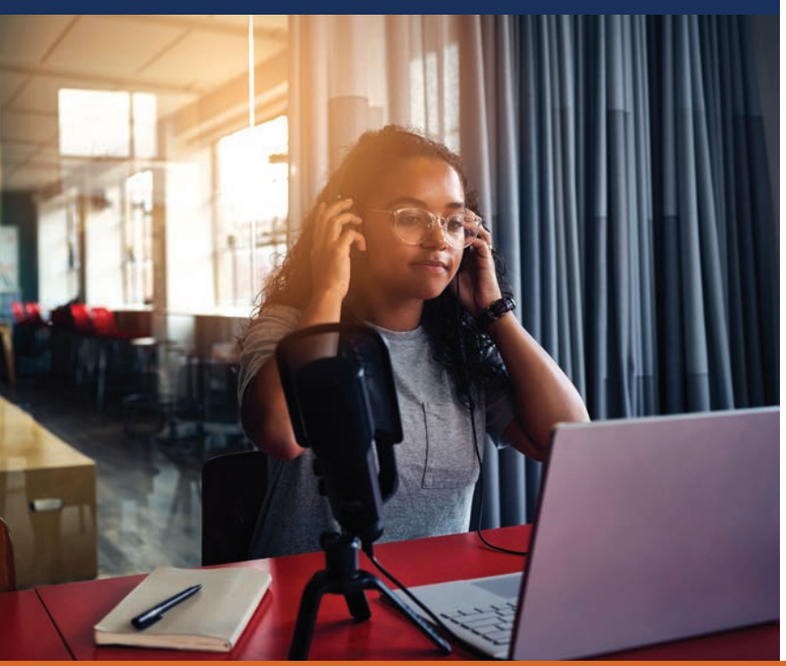
COUNTY	2010	2020	2030	2040	% Change 2010–2040
BURLINGTON	449	444	450	491	+9.4%
CAMDEN	514	510	519	555	+8.0%
GLOUCESTER	288	289	294	323	+12.0%
MERCER	368	372	382	407	+6.8%
NJ SUBREGION	1,618	1,615	1,646	1,776	+9.7%
BUCKS	625	620	590	657	+5.1%
CHESTER	499	514	494	563	+12.9%
DELAWARE	559	560	535	590	+5.6%
MONTGOMERY	800	819	779	864	+8.0%
PHILADELPHIA	1,526	1,591	1,668	1,656	+8.5%
PA SUBREGION	4,009	4,104	4,066	4,330	+8.0%
GREATER PHILADELPHIA	5,627	5,719	5,712	6,106	+8.5%

SOURCE: DVRPC, 2020.

dvrpc

BEST OF THE UNDERGROUND PRESS IN 2041

December 29, 2041



The big technology companies that increasingly control the media, and everything else, have editorial oversight over the national dialogue. As clicks and likes drive the media narrative, which largely depicts a world full of happy consumers, the day's news rarely digs into serious and systemic issues such as climate change, the disappearing middle class, crumbling infrastructure, racism and bias, or the role of technology in our lives. Many have turned to underground outlets for reliable information. This year saw a number of noteworthy stories. Here are some of this year's best underground reports.

Not Just an Internet Thing: Sorting Also Happening in Our Communities

Algorithms personalize themselves to us; when employed by social media platforms, they give customized information and surround each of us in a "filter bubble" of like-minded people. This degrades the sense of shared reality and increases political polarization. As algorithms become more complex, it becomes much harder to know what hidden biases or favoritism are embedded within them.

The internet's personalized filter bubble effect is spilling over into the real world as people sort themselves into increasingly homogenous communities. At the same time, geographic inequalities have increased as more and more government responsibility has been devolved to the local level. For example, low-income towns often accept undesirable land uses such as landfills and incinerators in exchange for badly needed public school and transit funding. Asthma rates are correspondingly high in these areas. We must break our digital addictions in order to find solutions to the socioeconomic challenges we face in the real world.

It's a Bird, It's a Plane, It's a...Flying Taxi?

Mercer County, New Jersey, is sponsoring a six-month pilot program to test passenger-carrying, automated electric vertical take-off and landing (eVTOL) vehicles. The vehicles can pick up and drop off passengers at designated landing sites, called vertiports. Many of the stops in this trial are repurposed parking garage rooftops and parking lots, or existing helipads. "This project is decades in the making," says Mercer County Aviation Director Renato Gibbs, "Companies have been researching and developing this technology since at least the 2010s." While this trial will test the ability of flying taxis to serve commuters, many experts predict their real market will be in city-to-city travel with distances between 50 and 200 miles.

Since they use electric propulsion, they do not have operational emissions and are quiet enough not to cause a disturbance. However, there are concerns that these operations will result in further loss of privacy, particularly when eVTOL vehicles fly over private property. There are also the questions of safety, particularly if vehicles fall out of the sky; affordability, which could raise more concern about growing inequality; and the visual effect of vehicles taking off, landing, and traveling in the sky. Federal Aviation Administration (FAA) official Jane Sweeney says it is an opportunity to "test the regulations, policy, procedure, guidance, and training programs the FAA is developing to support eVTOL operations." By making transportation work in all three dimensions, eVTOL services can bypass the worsening gridlock on the ground and overcome the poor infrastructure conditions holding automated vehicles back.

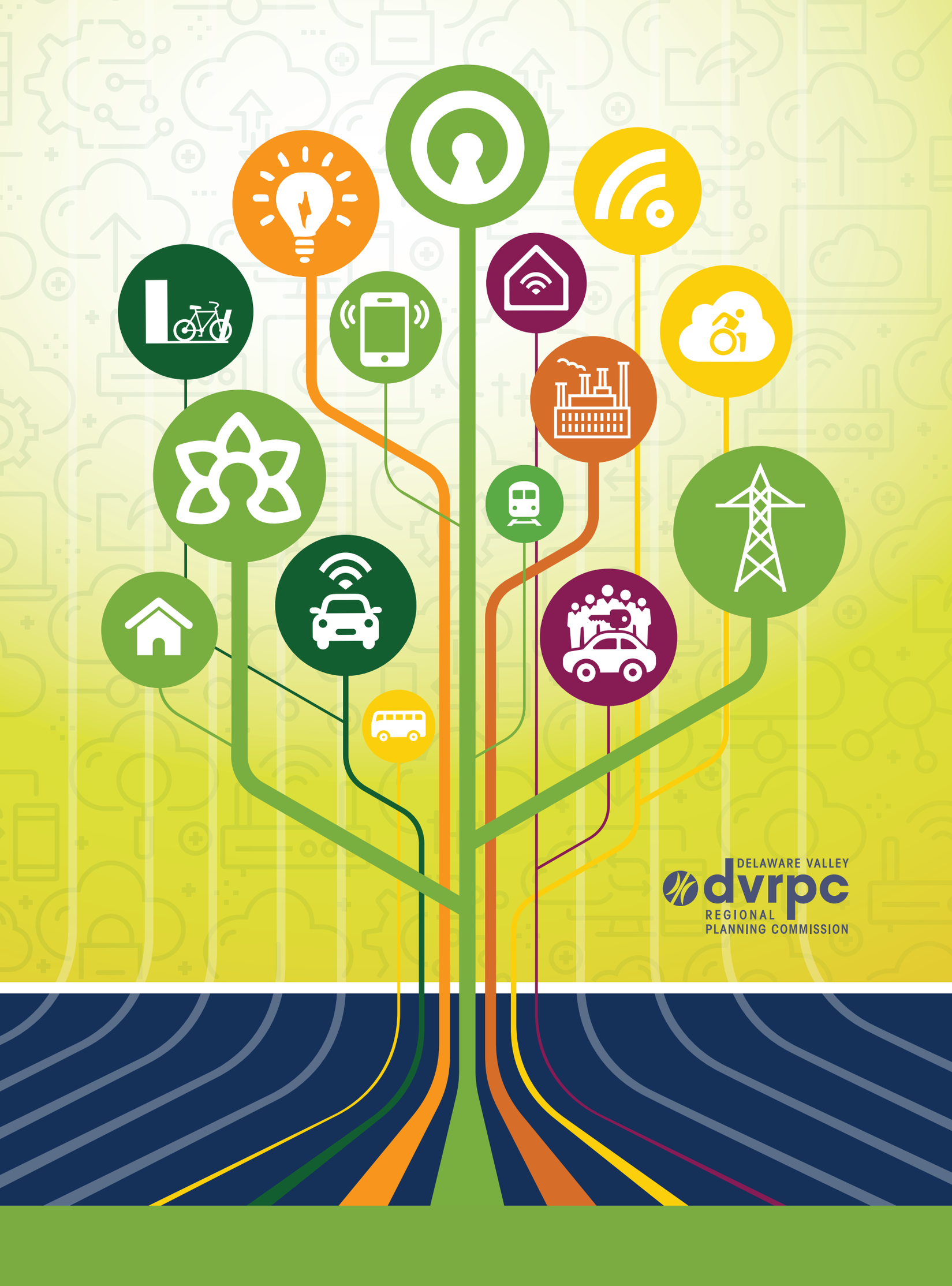
Algorithms and Big Data Put Technology in the Driver's Seat

Personal data collected through the Internet of Things—including smartphones, smart speakers, smart home and smart city devices, and connected and automated vehicles—is creating a bigger gap between the haves and have-nots. While most people knowingly trade personal data for basic digital services, those who collect that data are the real beneficiaries. They use this data to learn and understand everything about us, and use it to develop algorithms that ultimately shape our thinking, buying habits, and behaviors, and direct our digital relationships.[83]

Algorithms increasingly manipulate our day-to-day existence. The largest, most powerful organizations use technology to strengthen their grip on the economy and exacerbate some of the day's most pressing issues. Until we recognize as a society that technology is only as good as the hands it is in, we will be unable to solve the greatest challenges of the day.

Little Progress in Slowing Climate Change, Despite Technological Advances

From cars that drive themselves, to cryptocurrency, to the Internet of Things, to augmented reality, the last few decades have been filled with earth-shattering technological developments. These technologies have improved quality of life and are extending lifespans for those who can afford them. Yet despite these advances, there has been little progress in slowing down the ravages of climate change. Philadelphia topped 95°F in early February this year. The last Poconos ski resort recently closed its doors due to lack of snowfall and inability to generate enough of it during warmer winters. While our markets place a high value on innovation, they still have not found ways to fully value workers or the ecosystem within which the economy operates. Without establishing these values, it is no wonder recent innovations have not been tasked with slowing rising inequality or the greenhouse gas emissions that are causing climate change. ■


DELAWARE VALLEY
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REGIONAL
PLANNING COMMISSION

The following section provides a glimpse into a possible future—characterized by high levels of political will and collective action, and transformative change in technology—through a series of fictional news articles. None of these articles are seen as optimal or preferred futures for Greater Philadelphia. Rather, they show the opportunities and challenges in how key driving forces may shape the region over the next several decades, and how the decisions we make and our reactions to these forces may shift their implications.

A collaborative, networked, open source economy of abundance emerges from societal efforts to make technological advances more sustainable and equitable.

INCLUSIVE TECH

dvrpc

2020s

INCLUSIVE TECH

The COVID-19 pandemic accelerates the move toward decentralized production and household autonomy. This crisis and the Black Lives Matter movement highlight the need to use technology to combat misinformation and ensure everyone's voice is heard. A Data Bill Of Rights combats algorithmic bias while empowering and protecting individuals and their privacy. As a result, there is a significant increase in jobs monitoring and auditing algorithms and AI programs. Social media and the internet create a more engaged and informed society, particularly around social and ecological problems.

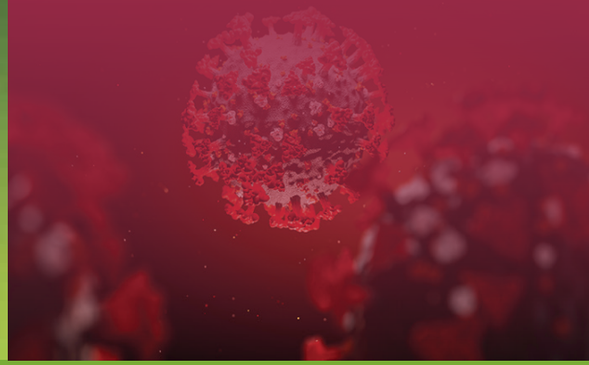
The United States recommits to international climate agreements and takes sweeping action at the national level. The federal government issues a "Clean Technology Challenge" that incentivizes innovation and entrepreneurship in an effort to rebuild the COVID-19–ravaged economy. ■

March 8, 2023

BREAKING NEWS

In Ode to Inventor of Polio Vaccine, Biotech Foundation Renounces COVID-19 Vaccine Patent

Executive Director of the International Foundation for Coronaviruses, Marten Drosten, has announced that the long-awaited COVID-19 vaccine will not be patented and will be made available for anyone to produce. Citing the hundreds of millions of donations that kickstarted the foundation in late 2020 and collaboration with research institutions from around the world, Drosten said that the vaccine belongs to the people. In their third year of intermittent stay-at-home social distancing orders, Americans are anxious to vaccinate and build a new post-coronavirus normal. "Let this be one less obstacle in the global supply chain, whose disruptions in recent years have wreaked as much havoc as the virus itself," said Drosten.



June 25, 2025

End of the Road for Brick-and-Mortar Retail?

Today marked a gloomy day for the brick-and-mortar retail industry as Macy's shut down its last physical location in the United States, closing its doors for the last time in Center City, Philadelphia, and switching to a full-service online platform. In the last decade, more and more stores have closed their physical locations, trading them for showrooms, warehouses, and websites in the wake of the post–COVID-19 retail collapse.

The closing of Macy's substantiates the warnings of Netscape co-founder and Silicon Valley venture capitalist Marc Andreessen over a decade ago. "Retail guys are going to go out of business, and e-commerce will become the place everyone buys," he said in a 2013 interview. "There is a fundamentally better model."[84] Since the inception of e-commerce in 2000 and the ramping up of safety features and fast deliveries as technology became available, revenues have more than quadrupled, soaring from a little over $170 billion in 2010 to just under $750 billion this year, making up more than 75 percent of all product sales.[85]

Despite the steep rise of online shopping, there has been a notable decrease in consumer spending. A collective will to reduce carbon footprints in every sector continues to impact consumer buying habits and has driven many shoppers toward second-hand items via online thrift stores like ThredUp and sustainably made products.[86] In addition, 3D printers are enabling people to produce more of what they need at home.

Carbon emissions have decreased as a result of e-commerce and the growing resale sector. Advances in logistics coordination among retailers and last-mile delivery service providers have made a huge dent in vehicle miles traveled, and trends toward the circular economy have made major cuts to global carbon emissions. "Buying one used item reduces its carbon footprint by 82 percent," says research firm Green Story Inc.[87] While beloved historical department stores continue to decline, the quality of the products have continued to grow with the availability of rating systems. As much as 85 percent of shoppers rely on the opinion of others before making their purchases: something that could not be done as easily in a physical store.[88]

The Fashion District Philadelphia and Suburban Square show a path forward for commercial space, with community-focused services popping up daily. Gyms, restaurants, pop-up and experiential stores, and live entertainment areas continue to pull people away from their computers to engage face to face with one another. The shift from transactional to experiential is palpable, and retailers unwilling, or unable, to change with the tides will soon be swept into history's dustbin. ■

April 22, 2022

Major Legislation Gives Hope against Climate Change

Following a series of droughts, fires, hurricanes, severe storms, and heat waves that have overwhelmed the nation and the world, resulting in hundreds of thousands of fatalities and major blows to the global economy, climate activists rejoice around the Earth Day passage of the 2022 Accelerating Clean Technology Innovation for Climate and Equity (ACT-ICE) Act.

This major piece of federal legislation aims to reduce greenhouse gas emissions. It follows the United States' participation in the Bari Climate Initiative at the 2021 G20 Summit in Bari, Italy; and the nation's re-entry into the Paris Agreement, recommitting the United States to carbon neutrality by 2040. The ACT-ICE Act puts innovative technological strategies for carbon neutrality at the forefront of the political agenda.[89]

"ACT-ICE is just one tool in our toolbox that will help us reach our ambitious, but attainable, goals set in the Paris Agreement," said Senator Andre Rubin (I-New Jersey) at yesterday's press conference. Rubin is one of the co-authors of the bill. "The only way we're going to reach our carbon-neutral goals is to set strong standards for the reduction of greenhouse gas emissions in high-emissions industries like the transportation sector."

The ACT-ICE Act aims to stimulate innovations in the private market and leverage what its proponents hope to be considerable private funds, while avoiding favoritism toward a specific technology or mode. It aims to do this in three ways: first, through subsidies and low-interest government financing for carbon-neutral technologies; second, increasing regulation on goods and services to further stimulate investment around climate, equity, and health concerns; and third, by applying a carbon tax as a way to both fund investments and stimulate innovation. The carbon pricing structure is based on risk and is set well above market rates (around $150 per ton) from day one.[90]

ACT-ICE will create a locally administered Community Jobs Program (CJP). It will also develop a national Climate Communications Network app that helps individuals prepare for, and respond to, emergencies; gently nudges more sustainable behavior; and act as a portal to the CJP.

Revenue from the carbon tax will directly fund the subsidies for innovative technological advances toward carbon-neutral buildings, manufacturing, energy production, transportation, agriculture, and other sectors. The fund may also be used for building low-carbon infrastructure, such as electric vehicle charging stations, and for workforce retraining programs.[91] The Act will also fund investments in environmental protection and the expansion of biodiversity, which health experts say can help to prevent future pandemics.[92] ■

October 13, 2026

Robotic "Road Butlers" Coming to Crash-Prone North Philly

After careful community consultation, the City of Philadelphia is deploying a fleet of robotic "Road Butlers" to North Philadelphia neighborhoods where crash rates remain stubbornly high, despite the city's Vision Zero efforts. Road Butlers contain cameras that monitor roadways and prevent vehicles from blocking through lanes or intersections, help travelers with navigation, provide safe pedestrian guidance, and reroute traffic during emergencies and special events.

The goal of the new addition is to maintain safe and orderly traffic flow as a variety of highly automated vehicles (HAVs)—parcel delivery bots, self-balancing scooters, 10–12-passenger shuttles, one- or two-passenger pods, self-driving e-bikes, and others—proliferate on roads.[93] These HAVs travel at slow speeds in designated, well-mapped areas and under specific weather conditions. They are mostly shared through ride-hailing services or utilized for deliveries.

The 2022 Accelerating the Deployment of Automated Passenger-vehicles and Trucks (ADAPT) Act set strong standards to eliminate transportation fatalities and greenhouse gas emissions; build a dedicated short-range communication network that lets vehicles talk with each other and infrastructure; develop a certification process to objectively review HAV hardware and software through safety criteria, simulations, road tests, and third-party review; enhance HAV–human communication; and ensure vehicles recognize road users regardless of race, height, clothing, or physical ability.

The federal government has guided innovation through a series of challenges to reinvent transportation and vehicles around human needs, and used open source approaches to share advances and understanding across HAV developers. "We're seeing the fruits of those efforts now with the emergence of all kinds of new, low-emissions vehicles," says Federal Highway Administration Connected Automated Vehicle Program Manager Deyvris Gonzalez. "We continue to work with citizens to understand their concerns with the technology and improve their comfort with it."

Widespread HAV adoption is credited with falling crash rates nationwide. Philadelphia's most crash-prone neighborhoods tend to be low income or otherwise disadvantaged. They have seen a small dip in crashes, but nothing close to the improvements wealthier neighborhoods have seen, widening the pre-existing disparity. "Where they are common, self-driving vehicles have done wonders for Vision Zero," explains Joanne Farley, Philadelphia's Vision Zero Director. "The problem is where they aren't." Many low-income and rural communities are falling behind as residents have a harder time affording new technologies, and on-demand services have been slow to arrive in these areas.
It remains to be seen how the city can address this inequity, and whether Robot Butlers can address higher crash rates in North Philadelphia. ■

2030s

INCLUSIVE TECH

Major breakthroughs in quantum computing and AGI pave the way for Level 5 HAVs that can finally take a passenger between virtually any two points without the need for human driver intervention. Open source HAV developers, such as Comma.ai, and non-profits, including public transit—which is increasingly the backbone of the transportation network—are the most successful providers.

The Climate Communications Network is evolving into an open source, general-purpose participatory democracy platform that flattens government hierarchies and horizontally manages more and more of the nation's affairs while bringing all voices into the conversation. However, the economic boom from HAVs and low-cost, clean energy made available through distributed microgrids is short lived, as it disrupts the fossil fuel energy paradigm. What once amounted to one trillion dollars in energy assets quickly becomes worthless, leading to a major downturn that reverberates throughout the global economy.[94] The spread of automation, AGI, and robotics in the workplace fuels an abundance of goods and services in the market while worsening the job crisis due to the energy recession. The ACT-ICE Act's expansion of community-based jobs helps to soften the blow. ■

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June 11, 2032

Payment for Personal Data Adds to Welfare State

If you have a wearable device, a smart home, a connected vehicle, or even a pacemaker, you can look forward to receiving some extra change in the mail starting next year. A major privacy bill signed into law on Capitol Hill Thursday will supersede California's 2027 law, reshaping how Silicon Valley does business throughout the entire country. The U.S. Data Rights and Dividends (DRD) Act is being hailed as a Data Bill of Rights and requires tech companies to ask your permission to use and sell your data, and must make a nanopayment in return for data proportional to the degree of contribution and value provided.

In addition to requiring payment for data, the DRD Act's data-rights infrastructure calls for data cooperatives that enable collective action and advocate for users, ethical data certification programs, specialized data-rights litigators and auditors, and data representatives who serve as fiduciaries for the public with the ability to parse the complex impacts that data can have.[95] Implementing the DRD Act will have many challenges along the way, particularly as small details get tested.[96]

This groundbreaking legislation comes 15 years after *The Economist* dubbed data as the world's most valuable resource,[97] and privacy advocates say that tech moguls have gotten away with what they call highway robbery for far too long. "A market economy should not just be about 'business,' but everyone who provides value," said Secretary of Technology Jared Lanzer, who had a large part in crafting the bill before his appointment. "People now have the opportunity to be full market participants, as earners and customers, rather than partial ones that are manipulated in and by digital networks."[98]

The legislative move has received criticism from privacy activists and business interests alike. The former argue that the government should help individuals to maintain their privacy, not encourage them to give it away for crumbs.[99] Tech giants who have opposed the Act, on the other hand, point to concerns that people may cheat the system for increased dividends by generating fake data, either with software packages or, as one Chester County woman was caught doing, attaching a tracking device to an outdoor cat. Still, the DRD Act is expected to boost the economy by supporting the middle class, making it hugely popular with everyday Americans who are ready to cash in on the value they have been providing all along. ■

December 16, 2036

Push for Programmable Roads as Carbon Tax Dwindles

The move toward a carbon tax to finance infrastructure was, perhaps, too effective. The 2024 move to reduce greenhouse gas emissions through a well-above-market-rate of $150 per ton did the job quickly, spurring a sudden and dramatic transition to renewable energy, electric vehicles, and other innovations.[100] But as carbon emissions dwindle, the funds they generate decline with them.

The carbon tax brought about a decade-long infrastructure funding infusion. These revenues fueled a dramatic improvement in infrastructure conditions, invested in climate mitigation, and funded early automated vehicle technologies, such as integrated traffic and transit management systems. However, intended consequences in vehicle design have had unintended consequences on transportation infrastructure. There are now a countless variety of vehicles—automated, unautomated, motorized, non-motorized, shared and not shared, occupied and unoccupied—fighting over the same limited roadway space; while transit and personal vehicle travel have blurred to where they are increasingly difficult to distinguish.

CREDIT: DIRECT LINE

Artificial intelligence programs have been tasked with keeping traffic flowing, despite the complexity of so many different modes moving at different speeds and requiring different berths. However, road design has not kept up with the new reality. Today's roads need rapidly reprogrammable digital infrastructure embedded into them in order to respond to the moment-by-moment changing needs of users. These curbless, "flexible streets" light up to assign roadway space for each mode present.[101] If more cars and buses are trying to traverse it, it can ban parking and open an additional lane; during events with high pedestrian volumes, it can temporarily close to automobile traffic.[102] Such surface signaling could delineate space for automated scooters separate from individual pods, mobile home and office spaces, legacy (non-automated) vehicles, non-motorized bikes, and pedestrians.

The carbon tax also changed how transportation infrastructure is financed and built. State and local departments of transportation, as well as transit agencies, are incentivized to reduce their carbon emissions. As a result, there has been considerable research and experimentation on low-carbon transportation infrastructure construction and maintenance, particularly around 3D printing and the use of new or recycled materials.

While the advances are laudable, questions remain. Where will the funding to make the next round of infrastructure upgrades come from? Increased deficit spending? A global tax on wealth, which has been floated as a new funding source to fill the carbon tax gap? Something else? Answers are needed soon. Despite being complex and chaotic, roads need to be kept safe and flowing more than ever. In an age of constant, rapid change, we must find ways to deploy the infrastructure and technology needed to keep up. ■

12.16.36

August 28, 2039

Opinion: It's Time to Admit the Office Market Isn't Coming Back

Former office buildings still shape the skylines of cities big and small, serving as a reminder of their previous role as cathedrals to commerce. The COVID-19 outbreak showed the world that work could continue outside the office, and demand for commercial real estate plummeted as large firms decentralized. Shorter work weeks, the rise in online learning, and decline of brick-and-mortar retail have added to the glut of vacant space. Still, the economy has managed to grow with less commercial real estate. The pandemic of the early 2020s strengthened digital technologies, which have driven post–COVID-19 growth by offering new ways of working and communicating.

Building owners have tried a variety of ways to regain relevance: offering activities such as ping-pong and pool tables, bocce courts, arcade games, and other activities. But many communities now offer similar amenities in public spaces. Buildings have also become greener over the past two decades and incorporate more natural features and forms, said to increase cognitive function, mental stamina, and focus. While all good-faith investments, none have taken the American office building off life support.

There have been a few bright spots for commercial spaces. One has been the rise of meeting spaces and collaboration centers, used for face-to-face appointments, training, intensive work sessions, and social events.[103] Another has been the creation of live-work space, much like once-abandoned factories were converted to artist lofts.[104] Maker spaces have been another common reuse. Even so, 47 percent of the region's office space still sits empty, up from 44 percent a year ago, despite going on five years of economic growth since the fossil fuel bust.

While this may be taken as a sign that we are headed into another recession, Temple University Economics Professor Ravi Singh thinks something else is happening. "We are living through a major structural change in our economy. As our technology becomes more efficient, it is drastically affecting our need for space." Singh notes that the long-term trend of bigger and bigger houses continues unabated, as more work has shifted into the home. While vacancies have been a major blow to municipal revenues, they have made many U.S. cities more affordable to live and work in. There are other benefits as well. With less commuting, anxiety is down and family time is up. Many find life easier with no or reduced car ownership, and there is less need for expanding transportation infrastructure. As the lifestyle changes that began with COVID-19 start to look permanent, it is time for a serious re-evaluation of the office business model. ■

Carbon emissions are down by more than 75 percent, and appear to be headed to zero thanks to major technological advances. Despite this, severe climate events continue to plague the region and the world.

The decentralized nature of the cooperative, open tech economy has empowered individuals while weakening intellectual property, big firms, and government. AGI is displacing workers. The economy has never been more productive, despite challenges from climate and the decline of big businesses. 3D printing and small automated food-growing huts help more and more households to be self-sufficient. The "circular economy" expands as 3D-printed items come with instructions on how they can be deconstructed in order to reuse their materials. A variety of different income resources—including broader capital ownership; nanopayments for data generation; solar energy credits; and subsidies for community-based work, food, and education—helps those who cannot find work to get by. This is made easier by an increasing abundance of goods, bringing down their cost. ■

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2040s
INCLUSIVE TECH

March 9, 2041

2040 Census: Greater Philadelphia Growth Still Driven by Foreign Immigration

Greater Philadelphia's population stood at an estimated 5,991,826 on April 1, 2040, according to recently released U.S. Census data. The region's population has risen by more than 96,000 people over the past decade, a 1.6 percent increase. After rapid growth in the 2010s and 2020s, the city's growth slowed to just 1.2 percent over the past decade. Gloucester and Chester counties had the highest growth rates in Greater Philadelphia.

The region's growth continues to be driven by foreign immigration, as net domestic migration remains negative and deaths outpace births. Over the last decade, the region has averaged nearly 60,000 births each year compared to 69,400 deaths. Domestically, 146,400 residents have left the region each year compared to 131,200 moving in. Over the last decade, 647,400 people immigrated to the region, while 303,100 U.S. citizens moved overseas.

Overall, the number of people of color increased by nine percent over the last decade and now makes up 44 percent of the region's population. The region's median age is now 42.6 years old. The population under age 16 decreased by 6 percent since 2030, while the over-65 segment continues to rise, increasing by nearly 12 percent over the past 10 years. There are now nearly 1.32 million residents over age 65 in the region.

The Greater Philadelphia region is now the 11th-largest in the country—trailing the New York, Los Angeles, Chicago, Dallas-Fort Worth, Houston, Washington, DC, Miami, Atlanta, Phoenix, and San Francisco regions. Overall, with decentralized technology allowing more people to work remotely, much of the nation's growth has been shifting to smaller towns and regions with good weather, easy access to open space, and a lower cost of living. ■

GREATER PHILADELPHIA DECENNIAL CENSUS POPULATION (IN THOUSANDS)

COUNTY	2010	2020	2030	2040	% Change 2010–2040
BURLINGTON	449	445	462	477	+6.2%
CAMDEN	514	511	530	530	+3.3%
GLOUCESTER	288	289	301	312	+8.3%
MERCER	368	372	389	389	+5.8%
NJ SUBREGION	1,618	1,616	1,683	1,708	+5.6%
BUCKS	625	624	632	641	+2.6%
CHESTER	499	517	530	554	+11.1%
DELAWARE	559	564	569	573	+2.5%
MONTGOMERY	800	825	829	841	+5.1%
PHILADELPHIA	1,526	1,616	1,656	1,675	+9.8%
PA SUBREGION	4,009	4,147	4,215	4,285	+6.8%
GREATER PHILADELPHIA	5,627	5,763	5,898	5,993	+6.5%

SOURCE: DVRPC, 2020.

dvrpc

OPEN SOURCE, INCLUSIVE TECH ALLOWING EVERYONE TO DESIGN THEIR COMMUNITY

February 7, 2043

The "democratization of production" has been the 21st century's biggest story.[105] The factory is everywhere, and everyone can contribute to design and production through open source technologies.[106] The decentralized nature of this emerging, cooperative, open tech economy is empowering individuals, who can now create and make most of what they need for themselves. A scan of recent, otherwise unrelated, headlines shows how these decentralizing technologies are reshaping Greater Philadelphia and beyond:

Economists Struggling to Adapt Theories to Growing Abundance

Rethinking Patents and Copyrights in an Open Source World

70 is the New 50: What Does This Mean for Healthcare, Pensions, Marriage, and the Job Market?

As AGI Overtakes Work, Community Jobs Program Is a Lifeline

Corporate Profits Decline as "Collaborative, Open Sharing" Grows

Unable to Stem the Flow of Information, China's Communist Party Falls

AGI Is All Knowing

Ashrams, Retreats, & Mega Marathons: This Year's Top Sabbatical Ideas

Will Conscious Machines Overtake Caring and Community Jobs?

Open source, digital technologies are changing the nature of the economy, vastly extending lifespans, breaking down large organizations, and

challenging individuals to find new meaning in a world with less need for work. The productive efficiencies brought about by these technologies are bringing net marginal production costs to near zero.[107] In other words, it is almost impossible to turn a profit. Trade is in decline as individuals increasingly use 3D printers to create many of the things they previously purchased. This path was set in the 2020s with the COVID-19 crisis recovery program, which included the massive build-out of the Internet of Things, constructing decentralized micropower plants and retrofitting buildings for energy efficiency.[108]

The fossil fuel bust of the 2030s can now be seen as the dying breath of the old economy. Since then, there has been a painful but fascinating readjustment as the economy has reorganized around renewable energy. What will humanity do in its next act? This exciting question is just starting to be addressed.

The world's complexity goes beyond the capability of any individual or group of individuals to understand. In response, more power and decision making—from governance to tackling climate change—has been delegated to artificial general intelligence (AGI) programs. Collaborative, democratic networks have brought nearly every citizen into a federal cooperative that manages the nation's affairs in a much flatter, horizontal organization. These artificial-general-intelligence-powered networks respond to citizen desires and preferences, as well as to the unique, complex dynamics occurring in each community, rather than a reliance on one-size-fits-all, top-down solutions to challenges. They also offer access to community-based work, ensuring that everyone can find a job, so long as further advances in AGI spare this field.

As work days shorten, healthy lifestyles and meeting biological needs are replacing jobs in structuring our days. Proper sleep, diet, and exercise are all major focuses. Most people now try to walk 25,000 steps per day. Running has moved from sport to obsession. The Christmas Day Continental Army Ultramarathon from the Delaware River to Trenton, New Jersey then to

Princeton, New Jersey, and back, had 60,000 runners participate last year—about 25 times as many troops who fought with General Washington. Federal guidance recommends everyone take at least a two-week sabbatical to focus on mental well-being each year. Nature and natural functions are being embedded into the fabric of our communities as they never have before.

Average lifespans are pushing well into the 80s. Not only are people living longer, but they are also more active and healthier later into life. This is clearly a good thing, but longer lifespans are challenging retirement savings and pension funds; and elderly divorce rates are on the rise. Intelligent robots are increasingly available to help care for the elderly and provide companionship.

If there is a downside to this era, it is a lack of privacy. The sheer overwhelming volume of data collected about everyone is about the only protection for individual anonymity—although if someone or an organization wants to track you, they can. This may just be a price we have to pay for our growing abundance of all kinds of products, which is bringing down the cost of nearly everything—and opening up whole new vistas for the human experience. The world is connected and open. What do we want to do with it? ■

Glossary

3D PRINTING: An additive manufacturing technique that produces three-dimensional solid objects from digital files.

5G: The fifth generation of cellular technology, designed to increase speed, reduce latency, and improve flexibility of wireless services.

ACCELERATING CLEAN TECHNOLOGY INNOVATION FOR CLIMATE AND EQUITY (ACT-ICE) ACT: A fictional piece of legislation set in a Delayed Expectations future.

ACCELERATING THE DEPLOYMENT OF AUTOMATED PASSENGER-VEHICLES AND TRUCKS (ADAPT) ACT: A fictional piece of legislation set in an Inclusive Tech future.

AMERICAN TRANSPORTATION INFRASTRUCTURE ACT OF 2021: A fictional piece of legislation set in a Delayed Expectations future.

ARTIFICIAL GENERAL INTELLIGENCE (AGI): Computer programs with an equal or greater level of intelligence than the human brain.

ARTIFICIAL INTELLIGENCE (AI): The theory and development of computer programs able to perform tasks that normally require human intelligence, such as visual perception, speech recognition, decision making, and translation between languages.

AUGMENTED REALITY: The use of technology to overlay information or an image on something being viewed through a digital device such as a smartphone.

AUTOMATED VEHICLES (AVs): Use hardware and both remote and on-board software systems to perform the functions needed to drive a vehicle.

B CORPS: A private certification issued by B Lab, a global non-profit organization, to for-profit companies that meet social sustainability and environmental performance standards.

BITCOIN: A decentralized digital cryptocurrency without a central bank or single administrator that can be sent from user to user on the peer-to-peer bitcoin network.

CIRCULAR ECONOMY: An alternative to a traditional linear economy that focuses on eliminating waste and the continual use of resources.

CLIMATE COMMUNICATIONS NETWORK: A fictional government platform for sharing climate change mitigation strategies in an Inclusive Tech future.

COMMUNITY JOBS PROGRAM (CJP): A fictional government program focused on sustainable community investment in an Inclusive Tech future.

CONNECTED VEHICLES (CVs): Vehicles that use dedicated short-range communications through licensed wireless networks, cellular technologies, satellite, the internet, and telematics to connect cars, trucks, buses, motorcycles, bicyclists, pedestrians, and infrastructure.

CRYPTOCURRENCY: A digital or virtual currency that is secured by cryptography, which makes it nearly impossible to counterfeit or double spend.

DECENTRALIZED ELECTRICITY GRIDS: Draw power from many local energy producers.

DECENTRALIZED RENEWABLE ENERGY (DRE): Renewable energy that is generated off the main power grid, including microrenewables, heating and cooling.

DIGITAL REVOLUTION: Began with the emergence of computers, digital data storage, and the internet, which have collectively shifted how humans communicate; changed the primary function of the economy from product manufacturing to information; and enabled software, automation, robotics, and outsourcing to replace low-skill jobs with high-skill ones.

E-COMMERCE: Use of the internet to conduct commercial transactions, including the digital transfer of money to facilitate the exchange.

ELECTRIC VERTICAL TAKE-OFF AND LANDING (EVTOL) VEHICLES: Electric propulsion aircraft that can take off, hover, and land vertically.

FAIR NEW DEAL (FND): A fictional future piece of legislation set in a People Power future that aims to strengthen antitrust, the social safety net, and personal privacy; and to reduce greenhouse gas emissions using readily available technologies.

FREE OUR DATA: A fictional social movement calling for algorithmic transparency in a Technology in the Driver's Seat future.

FUNDING AN EQUITABLE, ACCESSIBLE, AND SUSTAINABLE TRANSPORTATION INFRASTRUCTURE ACT (FEASTIA): A fictional piece of transportation legislation set in a Delayed Expectations future.

GIG ECONOMY: The provision of on-demand services by workers that may be conducted through a digital platform but does not offer stable long-term employment or the benefits that come with it.

HIGHLY AUTONOMOUS VEHICLE (HAV): A vehicle with an automated driving system that does not need a backup driver when operating on specific facilities (Level 3 AV), within a specifically defined operational design domain area (Level 4 AV), or at any place and time (Level 5 AV).

INTERNET OF THINGS: A system of interrelated computing devices, mechanical and digital machines, objects, animals, or people that are provided with unique identifiers and the ability to transfer data over a network without requiring human interaction.

MACHINE LEARNING: A branch of artificial intelligence based on the idea that systems can learn from data, identify patterns, and make decisions with minimal human intervention.

MICROGRIDS: A local energy grid with control capability, which means it can disconnect from the traditional grid and operate autonomously.

MILEAGE-BASED USER FEE (MBUF): Charges for the use of roads more like a utility, based on system use. Is assessed at a specific rate per mile driven and can be imposed on either all vehicle miles traveled or only on specific facilities.

NANOPAYMENT: Digital payment totaling fractions of a cent made possible by cryptocurrency platforms.

NET NEUTRALITY: The principle that internet service providers should enable access to all content and applications regardless of the source and without favoring or blocking particular products or websites.

OPEN TECH ECONOMY: A part of the Inclusive Tech scenario, this is a decentralized economy where open source software and data enables a wide variety of individuals and groups—particularly users—to share knowledge and contribute to product design, and ensures that a range of technologies are interoperable.

PICOGRID: A small power supply system that provides connected items with limited capacity.

QUANTUM COMPUTING: Computers use combinable qubits, which can be any combination of value of 0s and 1s, and may be able to enable computational speed and possibilities far beyond classical computing capabilities, which are based on non-combinable bits that can be either 0 or 1.

REGULATORY CAPTURE: A situation where agencies that are charged with protecting the public interest instead act in ways that benefit the industry they are supposed to regulate.

ROADWAY AUTO AND SAFETY ADVOCATES: A fictional organization working toward safer roads in a Technology in the Driver's Seat future.

SAFE CONNECTED AND AUTOMATED TRUCKS AND VEHICLES (SCATV) ACT: A fictional piece of legislation set in a People Power future.

SMART CITIES: Collect and analyze data through sensors connected to the internet to monitor the environment, integrate systems in order to share information and functionality and gain efficiency, and use technology to perform actions remotely. Smart city practices can increase transparency, partnerships, and citizen engagement, as well as enhance user experiences.

SOUTHEAST PENNSYLVANIA REGIONAL TRANSPORTATION AUTHORITY (SPARTA): A fictional regional government agency set in a People Power future, charged with collecting local taxes and distributing them to transportation agencies in the region.

TRUCK PLATOON: Use connected and automated technology to link a group of two or more trucks together and let them travel in a convoy.

UNIVERSAL BASIC INCOME (UBI): A periodic cash payment delivered to all citizens of a government without a means-test or work requirement.

URBANSIM: A land use model that simulates regional real estate developer and household locational choices and how these are influenced by government policies and investments.

U.S. DATA RIGHTS AND DIVIDENDS (DRD) ACT: A fictional piece of legislation set in an Inclusive Tech future.

VISION ZERO: A transportation planning philosophy that aims to end fatal and serious injury crashes by protecting all roadway users through equitable engineering, education, and enforcement while prioritizing speed control.

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MEET THE EDITORS

EXPLORATORY SCENARIOS FOR GREATER PHILADELPHIA

DISPATCHES from ALTERNATE FUTURES

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In this position, he works with the Futures Group—an interdisciplinary stakeholder, expert, and public working group—that uses scenario planning to analyze how trends and forces are reshaping Greater Philadelphia. He has developed long-range financial plans that use performance-based planning, asset management, and mode-neutral project evaluation criteria. He has (co)authored a variety of key policy reports, such as *Networking Transportation* and the *Connections* (2035, 2040, and 2045) series of long-range plans.

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GEOGRAPHIC AREA COVERED Nine-county DVRPC region consisting of Burlington, Camden, Gloucester, and Mercer counties in New Jersey; and Bucks, Chester, Delaware, Montgomery, and Philadelphia counties in Pennsylvania.

ABSTRACT This exploratory scenario planning exercise was conducted with the Futures Working Group (FWG), and is a key step in developing the *Connections 2050* Long-Range Plan for Greater Philadelphia. This effort assesses uncertainty within a changing environment and aims to understand what conditions or events may emerge, along with their likely consequences. It identifies an expansive range of future scenarios that the Greater Philadelphia region could conceivably face through the year 2050: DELAYED EXPECTATIONS: a world overcome by climate change and economic slowdown; PEOPLE POWER: grassroots movement to a more just and sustainable future; TECHNOLOGY IN THE DRIVER'S SEAT: Big Tech takes control; and INCLUSIVE TECH: a new equitable economy emerges through open source technologies. The scenarios illustrate how the region may change over the next 30 years through a series of news articles from the future, which are based on modeling, research and dialogue with the FWG. A final step will be conducted as part of the *Connections 2050* Long-Range Plan update to determine potential actions to respond to the uncertainties outlined in the alternate scenarios, so that the region can plan and prepare for whichever environment comes to fruition.

KEY WORDS Alternate Futures, Big Tech, Climate Change, Connections 2050, Delayed Expectations, Demographics, Development, Digital Revolution, Dispatches, Economy, Environment, Forces, Futures Group, Futures Working Group, Grassroots, Housing, Impact, Inclusive Tech, Inequality, Land Use, Long-Range Plan, Open Source, People Power, Scenarios, Scenario Planning, Signposts, Technology in The Driver's Seat, Transportation Funding, Transportation Infrastructure, Transportation Technology, Trends, Uncertainty, Work

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Dispatches from Alternate Futures: Exploratory Scenarios for Greater Philadelphia is the result of the second exploratory scenario planning exercise for the Greater Philadelphia region and is a key step in an iterative process to develop the *Connections 2050* Long-Range Plan for Greater Philadelphia. Policymakers and public- and private-sector leaders can use this scenario exercise and the forthcoming Long-Range Plan to make informed decisions in the present that help guide the region toward more preferable outcomes as defined in the Plan's vision.

For ***Connections 2050*** products as the Plan is developed, please visit: **www.dvrpc.org/LongRangePlan**

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