Forge The Future is a project initiated by Pennsylvania businesses. Its goal is to unlock the economic potential of the state's world-class natural gas reserves, and ultimately advance an energy-enabled economy. In Phase I, Chevron and Peoples Gas invested in a state-wide econometric study by McKinsey with the goal of establishing a fact base and strategic directions for economic opportunities resulting from the state’s natural gas reserves.

The study revealed an unprecedented opportunity to create an economic growth agenda for Pennsylvania: the potential to add $60 billion in Pennsylvania GDP growth, more than 100,000 jobs and billions in state tax revenue.

What started as a project of Chevron and Peoples Gas, with a Steering Committee that included The Allegheny Conference on Community Development and the Chamber of Commerce of Greater Philadelphia, has now grown to include partnerships with the PA Chamber of Business and Industry, PA Manufacturers’ Association, and some 100 businesses, schools and organizations.
Pennsylvania’s world-class natural gas reserves can create vast economic opportunities. To rapidly advance and accelerate energy-enabled economic development, the FORGE THE FUTURE Steering Committee has created "WE ARE HERE" to create 5 strategy teams to engage Pennsylvania’s business community.

Each strategy team will:
- Identify and explore opportunities
- Anticipate potential obstacles
- Generate ideas to help achieve team’s strategy

ECONOMETRIC STUDY FOR DOWNSTREAM ECONOMIC DEVELOPMENT
- Grow our GDP by $60 billion
- Add 100,000 new jobs in PA
- Infuse billions into state treasury

PHASE I
EXPORT/ INFRASTRUCTURE
ADVANCED MANUFACTURING
ADVANCED MATERIALS
PETRO-CHEMICALS
HEAT & POWER GENERATION
COMMERCIAL & RESIDENTIAL

PHASE II
ENGAGE PENNSYLVANIA’S BUSINESS COMMUNITY

PHASE III
ADVOCACY & ACTION
Rapidly advance and accelerate energy-enabled economic development

Grow our economy, population, jobs and wages
Create thriving families and communities
Leave a legacy of opportunity for future generations

Publish Forge The Future Phase II Report

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# Table of Contents

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Executive Summary</strong></td>
<td>4</td>
</tr>
<tr>
<td><strong>Overview</strong></td>
<td>4</td>
</tr>
<tr>
<td>Pennsylvania’s Economic Performance</td>
<td>4</td>
</tr>
<tr>
<td>Forge the Future and the Size of the Prize</td>
<td>5</td>
</tr>
<tr>
<td><strong>Phase II: Ideas for Action</strong></td>
<td>6</td>
</tr>
<tr>
<td>Forge the Future Phase I: Establishing the Fact Base and Strategic Direction</td>
<td>8</td>
</tr>
<tr>
<td>Forge the Future Phase I Report Overview</td>
<td>8</td>
</tr>
<tr>
<td>New Opportunities and Job Growth</td>
<td>8</td>
</tr>
<tr>
<td>Attracting the Sectors of the Future</td>
<td>9</td>
</tr>
<tr>
<td>Pennsylvania’s Unique Strengths</td>
<td>9</td>
</tr>
<tr>
<td>Strategic Directions</td>
<td>10</td>
</tr>
<tr>
<td>Forge the Future Phase II: Engaging Pennsylvania Businesses and Idea Generation</td>
<td>11</td>
</tr>
<tr>
<td>Defining Ideas and Actionable Initiatives</td>
<td>11</td>
</tr>
<tr>
<td>Forge the Future: Ideas for Action</td>
<td>11</td>
</tr>
<tr>
<td>Educate and Spread Awareness</td>
<td>11</td>
</tr>
<tr>
<td>Make Energy a Priority</td>
<td>12</td>
</tr>
<tr>
<td>Review/Reform Tax Policy and Incentives</td>
<td>12</td>
</tr>
<tr>
<td>Collaborate on State Workforce Development</td>
<td>13</td>
</tr>
<tr>
<td>Petrochemicals</td>
<td>14</td>
</tr>
<tr>
<td>Heat and Power Generation</td>
<td>14</td>
</tr>
<tr>
<td>Advanced Manufacturing</td>
<td>14</td>
</tr>
<tr>
<td>Advanced Materials</td>
<td>14</td>
</tr>
<tr>
<td>Export/Infrastructure</td>
<td>15</td>
</tr>
<tr>
<td><strong>The Big Picture Summary</strong></td>
<td>16</td>
</tr>
<tr>
<td><strong>Endnotes</strong></td>
<td>18</td>
</tr>
<tr>
<td><strong>List of Participating Organizations</strong></td>
<td>19</td>
</tr>
</tbody>
</table>
Overview
Pennsylvania’s considerable natural gas reserves represent a generational opportunity for multiple industrial and commercial sectors. If the Commonwealth wants to fully capitalize on its energy assets, it must, in the short-term:

• Enact comprehensive tax reform that allows it to compete for investment
• Foster a regulatory environment that allows for innovation and expansion
• Invest in infrastructure to support upstream, midstream and downstream activity
• Establish leadership in the Governor’s Office to shepherd projects through the maze of permitting and regulations
• Partner with Pennsylvania universities to position the state as a center for innovation in 21st century manufacturing technology and workforce

Pennsylvania’s Economic Performance
The U.S. economy has gained momentum with Gross Domestic Product (GDP) growing significantly, people returning to the workforce and unemployment at historic lows. Against this national backdrop, Pennsylvania’s economic growth has lagged:

• Pennsylvania’s GDP growth is slow. From 2015 to 2016 the United States average GDP growth was 2.3 percent. During that same time, Pennsylvania saw an increase of only 0.1 percent, the second smallest increase of all U.S. Metropolitan Statistical Figures. In 2017, Pennsylvania’s GDP grew 1.8 percent. Mining, quarrying, and oil and gas extraction were the largest contributors of that increase, accounting for 0.38 percentage of the total growth.

• Our workforce is shrinking. While Pennsylvania’s unemployment rate dropped to 4.3 percent in June 2018, hitting the lowest point in 11 years, the decline continues to be driven primarily by a shrinking labor force, caused by retirements and people giving up looking for work. Since June 2017, the state’s labor force declined by 61,000 people, the 11th consecutive month of declines.

• Pennsylvania’s population is treading water. The U.S. Census Bureau estimates Pennsylvania added 18,000 people in 2017, after shrinking by 0.1 percent in 2016. But, that growth remains concentrated in certain spots.

In fact, populations are declining in 75 percent of Pennsylvania boroughs, which could result in the state losing representation in Congress with the next U.S. Census. Per the state’s Independent Fiscal Office, the only part of the population projected to increase over the near-term is the 60+ segment.

In addition, other states and regions have economic growth that is outpacing Pennsylvania and are growing their populations in tandem with stronger GDP growth. Beyond that, Pennsylvania faces continuing challenges to its fiscal budget. Rising costs, an underperforming economy and low population growth leaves Pennsylvanians with more legislative battles over the budget, and less opportunity to address vital community needs: infrastructure, education, health and social services among them.

These facts call for a focused, visible and achievable economic growth plan.

Specifically, one segment of Pennsylvania’s business community is poised to address this need—energy. Pennsylvania has world-class energy resources—we are within the third-largest natural gas and natural gas liquids (NGLs) field on the planet. An energy-enabled economy has the potential to dramatically improve our economic growth, create jobs, attract talent and improve the state’s fiscal health.
Paired with the state’s abundant water resources, attractive land siting options, developing infrastructure assets, ease of access to domestic and international customer bases (via freight cargo, overland trucking, rail, port and air) and a historically strong manufacturing-based workforce, the state has more opportunity before it than at any time in recent memory. Yet, only a fraction of this growth potential has been captured thus far due, in part, to limited market development and existing tax and regulatory policy.

**Forge The Future and The Size of the Prize**

Forge The Future is a project of Pennsylvania businesses committed to activating energy-enabled economic growth that has the potential to transform the Commonwealth’s slow economic and population growth to sustained, broad-based prosperity for all Pennsylvanians. The initiative includes three phases:

- Phase I: Econometric Study
- Phase II: Business Engagement and Ideas for Action
- Phase III: Activation of Ideas

In Phase I, Chevron and Peoples Gas invested in an econometric study by McKinsey to establish a fact base and answer the following questions: What is the potential for building economic growth on the world’s third-largest natural gas field? How can we increase demand for this valuable resource here in our state where it is produced—adding value to it here? And what role do exports play in facilitating in-state demand growth? The Phase I report, published in July 2017, featured five strategy tracks for further exploration:

- Heat and Power Generation
- Petrochemicals
- Advanced Materials
- Advanced Manufacturing
- Export and Infrastructure

The Phase I data showed that successful development of these “downstream” industries holds the potential for significant economic growth: a $60 billion increase in Pennsylvania GDP, the addition of more than 100,000 jobs, and an increase in natural gas demand of 4-5 trillion cubic feet—all of which would generate several billion dollars in additional tax revenue for the Commonwealth.

| Pennsylvania power and heating | • Build ~6,000 MW of new natural gas power in Pennsylvania
| Petrochemicals | • Convert ~500,000 homes heating from fuel oil to natural gas
| • Install ~2,200 MW of distributed combined heat and power
| Pennsylvania clusters | ▪ Build a world-class petrochemical hub with 3-5 ethane crackers, 3-5 PDH plants, 2-3 ammonia plants and inorganic chemical plants
| ▪ Expand into high-value specialty plastics manufacturing
| Advanced materials | ▪ Be the leading materials supplier for US northeast infrastructure growth (2-3% annual growth), harnessing historical strength in steel, aluminum, cement, and glass
| ▪ Establish the commercial hub of advanced materials technology (e.g., fiberglass, advanced cement) drawing on R&D leadership
| Data-driven automated manufacturing | ▪ Achieve national Top 3 position in data-hungry advanced manufacturing focusing on Pennsylvania leadership in robotics, artificial intelligence, and additive manufacturing
| ▪ Develop data center network (6-8 major centers) harnessing low-cost power, preparing for worldwide rollout of data-hungry Internet of Things
| Gas exports | ▪ Expedite key pipelines to increase gas exports by 3.6 Tcf by 2025, ensuring stable gas production needed for Pennsylvania long-term competitiveness and investor confidence
Phase II: Ideas for Action

Forge The Future was always meant to be a conversation starter and intended to achieve action toward energy-enabled economic growth. For Phase II of the project, energy and related business leaders from across Pennsylvania were invited to participate in the Ideas for Action process. Two workshops were scheduled – one in Pittsburgh and one in Philadelphia – to build on the Phase I strategies by generating ideas and actionable initiatives Pennsylvania can pursue to accelerate energy-enabled economic development and increase in-state demand for natural gas. These discussions yielded several critical ideas identified across multiple teams:

- **Educate and Spread Awareness:** A communications and education effort, involving the energy industry, the statewide business community and government leaders, must be initiated to affect a more thorough understanding across Pennsylvania of the historic economic growth potential afforded to us by our vast energy resources.

- **Make Energy a Priority:** There are billions of dollars in economic growth, wages and investment potential in play. Pennsylvania should have a focused staff and funding to support it.

- **Review and Reform Tax Policy and Incentives:** Federal tax reform is providing a catalyst for growth and investment in the economy, with a lower corporate rate that has returned America to a position of competitiveness with other nations. Pennsylvania tax policy should be reviewed and revised in the context of our potential growth in energy and manufacturing to better maximize downstream development of industries that will use our vast natural gas and NGL resources.

- **Collaborate on State Workforce Development:** Currently, there are an array of workforce development programs across the state, but little-to-no coordination. Pennsylvania should review all workforce development programs and identify opportunities for broad-based collaboration among agencies, civic leaders, private companies, foundations and educators to ensure our pipeline of talent has the knowledge, skills and training to fill the next generation of energy and advanced manufacturing jobs.

In addition to ideas that were common to all Phase I strategy tracks, business leaders also identified key actions necessary to achieve progress within the individual growth tracks. Below are the six recommendations that statewide business leaders determined are the most impactful ideas that emerged from the Phase II workshops:

1. **Position Pennsylvania as the leader of the next industrial revolution.**

   Connect state government, businesses and academia to make Pennsylvania the epicenter of next-generation advanced manufacturing that marries advanced production/operations techniques with smart digital technologies to develop cutting-edge advanced materials in plastics, carbon fiber, ceramics, glass and metals, as well as methane-derived products and materials.

2. **Utilize more natural gas-fueled technologies to power manufacturing.**

   Pennsylvania's low-cost natural gas resource can create significant economic benefits for energy-intensive manufacturers when used as a source of heat and power. In order to tap into those benefits, we need to identify ways to make it easier for manufacturers to adopt CHP (Combined Heat and Power) solutions, natural gas-fueled technologies like Solid Oxide Fuel Cells and distributed energy systems for their facilities, while ensuring the infrastructure is in place to deliver natural gas to the sites manufacturers want to occupy.

3. **Support the development of ethane storage and distribution hubs.**

   Large-scale storage of ethane and other NGLs is critical to developing a robust petrochemical and plastics industry in Pennsylvania. Building storage hubs capitalizes on existing infrastructure and natural resources, while driving additional investment that will create jobs and economic growth for the state.

4. **Expand the Pipeline Investment Program (PIPE).**

   Currently, the PIPE program provides grants to construct the last few miles of gas distribution lines to business parks, existing manufacturing sites and industrial enterprises. The program should be expanded to include residential uses so that citizens and communities can also benefit from the Commonwealth's low-cost energy source.
5 Streamline the permitting process for pipelines.

Developing natural gas transmission and distribution is vital to utilizing the abundant resource across the state, and delivering NGLs and LNG to export terminals, including a potential Penn America LNG facility in Chester County. Many regulatory hurdles exist, including oversight at both the state and federal level for natural gas infrastructure projects.

6 Proactively invest in site development targeted to the needs of petrochemical manufacturers.

Pennsylvania is poised for unprecedented investment in petrochemical manufacturing. To maximize the potential economic benefits, the Commonwealth needs to proactively work to address developmental and infrastructure limitations. Developing pad-ready sites throughout the state and preparing more sites for construction will attract future investments.
Forge The Future Phase I Report Overview
Pennsylvania has a world-class energy resource that is gaining attention and analysis. The state is currently sitting on untapped opportunities that could propel its economy and turn the Commonwealth into a leader in the 21st century global economy. Put simply, Pennsylvania faces a historic opportunity to unleash the full value of its Marcellus, Utica and Devonian shale resources and tap into a much-needed wellspring of GDP and jobs growth for decades to come.

In 2017, Chevron, Peoples Gas, The Allegheny Conference on Community Development and the Chamber of Commerce of Greater Philadelphia launched the Forge The Future initiative and commissioned an econometric study with the goal of establishing a fact base and strategic directions for economic opportunities from the state’s natural gas reserves.

The study, conducted by McKinsey, revealed tremendous opportunity to translate our energy resources into sustained, broad prosperity for ALL of Pennsylvania:

- $60 Billion in Pennsylvania GDP growth
- 100,000 jobs
- At least $2 billion in new state tax revenue
- 4.5 trillion cubic feet (Tcf) increase in gas demand

New Opportunities and Job Growth
In the decade since hydraulic fracturing and horizontal drilling innovations and technologies made shale gas accessible at scale, most of the focus in Pennsylvania has been on the upstream—the process of finding, developing and producing the gas resource. So, while the resource itself is being tapped, most of its value is not.

The full benefit of Pennsylvania’s energy resource will only emerge when the state’s natural gas supply is met by robust and sustained local demand—the downstream sectors that will multiply GDP, jobs and government revenues.

In the United States, shale gas production is expected to double by 2040, with most of the increase coming from Appalachia. Although Appalachia presents a vast market opportunity for shale gas utilization, the infrastructure and ecosystem needed is largely lacking. Historically, most of the ethane produced in the region has not been separated from raw natural gas; rather, it has been transported and combusted with methane for power and heating purposes. Given that DOE forecasts NGL production in the Pennsylvania, Ohio, and West Virginia tri-state region to increase seven-fold by the middle of the next decade, there is ample opportunity to support additional petrochemical complexes and market development, in addition to supporting exports of LNG and some NGLs to overseas markets.

Given the abundance of ethane and the region’s geographic proximity to downstream petrochemical markets, companies are exploring the feasibility of building more Appalachian ethane crackers.

While only one ethane cracker has moved from conception to construction (Shell), several studies have suggested the region could sustain 3-5 world-class ethane crackers.
Attracting the Sectors of the Future

Business and government leaders and economic development officials must thoughtfully consider the logical clusters that can be successful within the state. The productivity, innovation and prosperity of a region are often driven by clusters that represent unique concentrations of knowledge, skills and technology within a given field.  

Actively building clusters in Petrochemicals, Advanced Materials and Data-Driven Automated Manufacturing will capitalize on other intellectual and industrial advantages of the state and region and create the potential for large long-term GDP and jobs growth, positioning Pennsylvania as a leader of the next industrial revolution—a revolution where advanced digital technology transforms production processes. Competitive clusters will likely span cities and states, thereby requiring a big-picture approach in which economic development agencies and investors work in concert to weigh local and regional interests.  

The contributions of a fully-developed Pennsylvania/Appalachian chemical and plastics products industry could be significant, extending well beyond its direct economic footprint. If companies continue to invest in and build the petrochemical industry in the region, a petrochemical hub in a quad-state region consisting of West Virginia, Pennsylvania, Ohio and Kentucky could generate, by 2025, an estimated 25,664 direct jobs (chemicals and plastics products manufacturing), 43,042 indirect jobs (supply chain) and 32,112 “payroll-induced” jobs. Also, an estimated $1.7 billion in federal tax revenue annually and $1.2 billion in state and local tax revenue annually are predicted.  

While the U.S. Gulf Coast currently leads the world in petrochemical manufacturing expansion, there is a significant financial advantage for major petrochemical and plastics investment in this region because of our access to locally produced, low-cost ethane and close proximity to over two-thirds of U.S. polyethylene consumption. A 2018 IHS Markit study predicts that an ethylene project in this region will produce a net present value (NPV) on EBITDA of $930 million over the life of the project, compared to an NPV of $217 million for a similar project on the U.S. Golf Coast. Those financial advantages occur even when considering the higher capital cost for a project in this region and our less-developed natural gas and NGL pipeline and storage infrastructure.  

These opportunities reinforce the idea that an optimal future is one with a diverse and robust downstream ecosystem with multiple pathways for realizing the value of its shale gas reserves. This will require leadership across the public and private sectors to arrive at a unified vision and articulate that vision to the public and workers in a way that creates buy-in.  

Pennsylvania’s Unique Strengths

One of the state’s biggest strengths is its location. The Gulf Coast, although the center of the U.S. petrochemical industry since the mid-20th century, is vulnerable to hurricanes and power outages, whereas the PA/Northeast/Appalachian region offers the U.S. some added security and balance. The region is an ideal location for the emergence of a second major petrochemical manufacturing hub in the United States, offering benefits such as proximity to abundant NGL resources from the Marcellus/Utica shale formations and to manufacturing markets in the Midwest and the East Coast. In addition, Pennsylvania has a sufficient supply of NGLs to support a world-class petrochemical industry. Its major competitive advantage is access to an expanding supply of low-cost natural gas and NGLs (particularly ethane and propane) capable of supplying up to four additional world-scale, integrated ethane crackers similar in size to Shell Pennsylvania Chemicals. The state is also fortunate to have access to abundant supplies of water, a historically strong manufacturing-focused workforce and an established logistics infrastructure (such as ports, air, rail and trucking).
Strategic Directions

Now is the time for a more comprehensive view of energy-driven economic development—the downstream and demand-side.

Pennsylvania can achieve the concrete economic benefits defined in the Forge the Future Phase I report, through these five development strategies:

• Increased gas-fired power and heating: Ensure all Pennsylvania consumers and businesses feel the benefits of low-cost gas for heating and efficient power generation, enabled by intrastate pipelines and (in part) distributed power generation.

• Petrochemicals: Build a world-class petrochemical hub with three to five ethane crackers, three to five PDH (propane dehydrogenation) plants, two to three ammonia plants and inorganic chemical plants, while expanding into high-value specialty plastics manufacturing.

• Advanced Materials: Become the leading materials supplier for U.S. Northeast infrastructure growth and establish the commercial hub of advanced materials technology (e.g., plastics, carbon fiber, fiberglass, metals and advanced cement).

• Advanced Manufacturing: Achieve a national "Top 3" position in data-hungry advanced manufacturing focusing on Pennsylvania’s leadership in robotics, artificial intelligence and additive manufacturing.

• Gas infrastructure/exports: Ensure Pennsylvania always has enough outlets for its gas to keep production viable, sending a powerful signal that Pennsylvania competes on a global stage and is a lucrative destination for investment capital.

The Forge The Future Phase I report provides the analytical fact base that is a launching point for the ultimate objective—activation. What it will take, is the unwavering commitment of Pennsylvania’s leaders—in business, government, education and communities across the State—to forge our future by leveraging our vast energy and feedstock resources.

In 2018, the initiative moved to Phase II and engaged the Pennsylvania business community and other experts to build on the results of the study and identify ideas that will help achieve the Forge the Future strategies.
FORGE THE FUTURE PHASE II:
ENGAGING PENNSYLVANIA BUSINESSES & IDEA GENERATION

Defining Ideas and Actionable Initiatives
The direction outlined in the Phase I report is intended to be activated. What started as a project of Chevron and Peoples Gas, with a Steering Committee that included The Allegheny Conference on Community Development and the Chamber of Commerce of Greater Philadelphia, has now grown to include partnerships with the PA Chamber of Business and Industry, PA Manufacturers’ Association, and some 100 businesses and organizations.

To define ideas and actionable initiatives for making the potential energy-enabled economic development gains a reality, Forge The Future convened Pennsylvania business and other leaders relevant to five strategic growth tracks:

• Heating and Power Generation
• Petrochemicals
• Advanced Materials
• Advanced Manufacturing
• Infrastructure/Exports

The group identified actions to advance each growth track and optimize the economic opportunity at hand.

Forge The Future: Ideas for Action
Pennsylvania’s business leaders convened to discuss energy-enabled economic development. From significant content and ideas generated, this report reflects the processing and prioritization of the work.

There were four topics that were consistently raised across all the Ideas for Action deliberations:

1. Educate and Spread Awareness: Executives generally agreed that, for a state possessing the significant natural gas and NGL resources of Pennsylvania, there is relatively little attention paid to what they are, how large they are, what economic and environmental benefits can come from them, how the state and business community can work together to responsibly regulate and develop raw materials, what downstream industries will follow and much more.

When the initial Forge The Future report was published, it was unknown to many business leaders that the Commonwealth is within the third-largest natural gas and NGL reserves in the world. Just as consistent a reaction was that the report’s fact base and strategies represent a Pennsylvania vision/agenda for economic growth that is desperately needed. The enormous scale of this opportunity stood in stark contrast to the general lack of awareness and urgency around maximizing the value of this resource. There are voices of opposition to energy and/or fossil fuel development with organized and well-funded efforts to raise their concerns. The Forge The Future Ideas for Action teams believe that the citizens of Pennsylvania deserve a much fuller set of facts and opinions about how Pennsylvania can and will approach energy, advanced materials, manufacturing and exports related to our vast natural gas reserves.

It was agreed that a concerted effort must be made to better inform and educate the full range of stakeholders in Pennsylvania to ensure a broader understanding of the potential benefits of a growing energy economy, and a more balanced perspective on the potential risks. A robust communications and awareness-building effort, involving the energy industry, the statewide business community and government leaders, must be initiated to achieve a more thorough understanding across Pennsylvania of the historic economic growth potential afforded us by leveraging our vast energy resources. Awareness and education are energy growth and economic development imperatives.
2. Make Energy a Priority: The Forge The Future Ideas for Action teams felt strongly that Pennsylvania must more aggressively and efficiently make energy economic development a priority by creating an organization specifically designed to serve energy industry investors and partners through a coherent and focused statewide energy investment strategy:

a. Cabinet-level Energy Executive – Pennsylvania should create a cabinet-level leadership position (Energy Secretary, Executive, or "Czar") with exclusive responsibility for driving energy-enabled economic development in the state. This would give appropriate status to the energy economy and its potential to create significant GDP, jobs, wages and population growth impact.

b. Pennsylvania Energy Investment Office – Create a new Pennsylvania Energy Investment Office, led by a cabinet-level executive, to be the Commonwealth’s one-stop resource for helping streamline the process of doing energy business in PA – serving as an ombudsman to coordinate regulatory, permitting and other needs. The office should be staffed and funded appropriately, with the goal of leveraging economic growth, which, as this and other studies/reports have estimated, could be more than $60 billion.

c. Create Statewide Energy Investment Strategy - This new office would be charged with creating and leading a well-defined statewide energy business and investment strategy. This could include an energy-focused business attraction/investment resource kit for local and regional economic development agencies, and regular interaction to coordinate and collaborate on energy-related economic development.

In addition, such a move would help Pennsylvania improve its reputation in the business community. Forge The Future Phase I reported that Pennsylvania is not perceived as a "friendly" place to do business relative to its competitor states/regions. High taxes and relatively low scores on ease of starting a business and getting permits/licenses (environmental, health/safety, zoning) create both perceived and real obstacles that can inhibit investment and growth. The state also scores low on navigating the labor market to hire and train workers.

A dedicated energy economic development entity in Pennsylvania state government would send a strong signal to existing and potential investors. If Pennsylvania is committed to realizing and optimizing the full economic potential of its natural gas resources, this idea for Action should be given serious consideration.

3. Review/Reform Tax Policy and Incentives: Today, federal tax reform is more evidence that pro-growth tax policy will enable economic expansion. Lower corporate and individual income taxes and establishing tax policy (such as full expensing and increased flexibility with the use of carrying forward net operating losses) that spurs investment will provide a catalyst to growth and investment in the economy, spurring significant increases in GDP and employment. The U.S. lowered its corporate tax rate to be more competitive with other nations. Pennsylvania should follow this growth-enabling policy:

a. Reduce Pennsylvania’s Corporate Net Income (CNI) tax rate – It is one of the highest levels in the nation at 9.99 percent and should be reduced significantly, in conjunction with comprehensive tax reform at the state

b. Pennsylvania Energy Investment Office – Create a new Pennsylvania Energy Investment Office, led by a cabinet-level executive, to be the Commonwealth’s one-stop resource for helping streamline the process of doing energy business in PA – serving as an ombudsman to coordinate regulatory, permitting and other needs. The office should be staffed and funded appropriately, with the goal of leveraging economic growth, which, as this and other studies/reports have estimated, could be more than $60 billion.

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level. Such reform would include full expensing of capital investment, spurring economic growth by allowing for full deduction of purchasing machinery, equipment and buildings. High taxes on business in general and energy discourage investment and expansion into the sector of the economy that has the most potential to drive the state’s economic growth.

b. Eliminate Caps on Net Operating Loss Carry-Forward - Pennsylvania is one of only two states to limit the use of Net Operating Loss Carry-Forward – the ability to apply net operating losses to future tax liabilities. Like many states, Pennsylvania offers this credit for up to 20 years, but caps the deduction at 35 percent of current tax liabilities for 2018 and increasing to 40 percent for tax years thereafter. The use of carrying forward net operating losses is vital to the success of capital-intensive industries, in particular manufacturers who must invest significantly in the early years of the firm’s operations. Economic developers in Pennsylvania should leverage the opportunity to enable businesses to invest capital gains in economically depressed areas eligible for “Opportunity Zones” as afforded by the recently enacted Federal Tax Cuts and Jobs Act.

c. Upstream Tax Policy Review – Budget/revenue political battles over how to divide a stagnant pie are counter-productive and serve only as a disincentive to the kind of capital investment needed to grow the pie to the degree envisioned in the Forge The Future report. Conduct an independent, non-partisan assessment of all the taxes and fees currently paid by the upstream gas industry, benchmark that against our competitor states in a true apples to apples comparison; and, develop a competitive tax policy/position for the energy industry that maximizes both upstream and, by extension, downstream economic development, enabling billions of dollars in additional state tax revenues.

4. Collaborate on State Workforce Development:
Currently, there are an array of workforce development programs across the state, but little to no coordination. Pennsylvania should review all workforce development programs and identify opportunities for broad-based collaboration among agencies, civic leaders, private companies, foundations and educators to ensure our pipeline of talent has the knowledge, skills and training to fill the next generation of energy and advanced manufacturing jobs.

a. Increase Coordination – State agencies, private companies, educational institutions and foundations have initiated workforce development programs, but there needs to be greater collaboration and coordination among those efforts. Pennsylvania should petition for a Federal block grant, which would provide the needed resources for a comprehensive review of the current array of programs and enable better coordination.

b. Align Labor Needs with Education – Educators and the business community need to work together to pinpoint gaps in the workforce, identify future demand and create tailored curriculum so that the workforce can gain the skills needed to obtain those jobs.

c. Modernize Career and Technical Education Programs – Enact policies that enhance and modernize the educational programs at vocational schools, elevating them to magnet programs focused on training the state’s workforce of the future. To attract more students, enact articulation agreements that allow for easier transfer of credits between two-year and four-year schools.

d. Share best practices – Several institutions including Lackawanna College, Community College of Beaver County and Westmoreland Community College have programs focused on the oil and gas industry. Pennsylvania needs a way to share those best practices and programs, while encouraging recruitment.
In addition to ideas that were common to all Phase I strategy tracks, business leaders also identified Ideas for Action within individual growth tracks:

**Petrochemicals**
1. Proactively invest in site development targeted to the needs of petrochemical manufacturers
2. Support the development of much-needed ethane storage projects that are instrumental to a growing petrochemical industry
3. Expand the Resource Manufacturing Tax Credit Program, which now covers ethane, to include other NGLs

**Heat and Power Generation**
1. Create partnerships with organizations and institutions that operate large physical plants (government, universities, health care institutions) to build gas-fueled micro-grids for power generation
2. Develop partnerships between industries and STEM-focused colleges and universities to explore new technologies in distributed energy
3. Leverage utility ratemaking policy to facilitate adoption of natural gas as a heating and power source (such as CHP and fuel cells)
4. Expand PIPE, which currently provides grants to construct the last few miles of natural gas distribution lines to business parks and existing manufacturing and industrial enterprises, to include residential uses

**Advanced Manufacturing**
1. Create District Energy Zones where long-term Power Purchase Agreements would incent use of natural gas-fueled micro-grids for manufacturing facilities and support the work of the CHP working group within the Pennsylvania Public Utility Commission to identify additional ways to help manufacturers adopt CHP solutions for their facilities
2. Support site developers and infrastructure expansion to deliver gas to sites manufacturers want to occupy
3. Review all programs and resources being devoted by state government to economic development and energy incentives and issue a consolidated report. All programs should be reviewed to determine whether the correct priorities are being targeted, whether the incentives are effective, and whether they are necessary

**Advanced Materials**
1. Create a partnership between the Pennsylvania Department of Community and Economic Development (PA DCED) and the Pennsylvania business community: make a public and specific policy-supported commitment to creating a new industrial revolution that marries advanced production/operations techniques with smart digital and other technologies, such as robotics, analytics, artificial intelligence and cognitive technologies, additive manufacturing and advanced materials
2. Connect state government, businesses and academia
to make Pennsylvania a new epicenter for advanced materials, with a focus on plastics innovation, carbon fiber research and development, methane-derived materials and applications, ceramics, glass, metals, composites, semiconductors and polymers

3. Build off our state's strong industry and manufacturing legacy to create a "Manufacturing of the Future" pilot, the first of its kind in the U.S., integrating artificial intelligence, robotics and machine learning, while utilizing clean technologies, like natural gas-fueled solid oxide fuel cells, to create the needed power

Export/Infrastructure

1. Streamline the permit process for pipeline installation and expansion
2. Pursue state and federal support for additional east coast LNG export capacity, including a potential Penn America facility in Chester PA
3. Support Local Distribution Company (LDC) expansion, and create infrastructure to enable it
4. Support infrastructure connections to industrial sites
5. Support natural gas infrastructure development for use in transportation
   a. Seek federal and state assistance to convert all major transit fleets to gas powered buses
   b. Support installation of natural gas fueling stations at all PA Turnpike service plazas
   c. Develop port infrastructure for natural gas fueling on cargo ships in Philadelphia to take advantage of the eventual move from high-sulfur diesel
Pennsylvania and its citizens are at a crossroads between a stagnant economy and a historic opportunity to build a new, vibrant and growing Keystone State. The reported data (highlighted on page four of this report) on the state’s economic health and population decline illuminate what should be cause for concern – and aggressive action. **While Pennsylvania’s economy evolves with advances in technology, automation and applications across most industries, there is one that offers the potential to dramatically advance the state’s economic performance: energy.**

Forge The Future Phase I report, published in July 2017, established a fact base and five strategies that frame the path forward toward realizing Pennsylvania’s potential as a regional, national and global energy leader. To realize that potential, Pennsylvanians must work together to pursue a commonwealth where energy-enabled economic growth generates tens of thousands of high-quality employment opportunities that enhance the quality of life for its citizens and their communities.

In addition, we must educate the people of Pennsylvania on the scope of the benefits of this strategy and fully address concerns to create the broad-based support necessary to make this vision a reality.

Forge The Future Phase I identified the impact of the Commonwealth’s untapped opportunity:

- An increase to Pennsylvania’s GDP by 6-9 percent, or some $50-$70 billion
- An expansion of employment/jobs by more than 100,000
- An increase revenue flow to PA treasury by $2 billion or more

It defined Pennsylvania’s existing strengths to achieve it:

- **Energy Resource**: The state lies within the third-largest natural gas and NGL reserves on the planet – enough gas to deliver enormous “downstream” economic growth right here, while also enabling Pennsylvania to play a key role in making American energy independent for the foreseeable future
- **People**: Experienced manufacturing and technology expertise that is the base for a growing talent pool on which to re-build manufacturing and materials industries
- **Innovation Infrastructure**: World-class universities and other research institutions like the National Energy Technology Laboratory
- **Sites**: Brownfields that can be redeveloped and repurposed for a new, energy-enabled economy

In addition to defining the opportunity, Phase I also identified challenges and obstacles to reaching the state’s potential, including higher relative labor costs, power prices that don’t reflect the economic advantage of local
natural gas fuel, a relatively "unwelcoming" business climate with regard to taxes, permits/regulatory processes and efficiency, and workforce hiring/training issues.

This Phase II Ideas for Action report is the product of collaboration among Pennsylvania's business leaders from across the Commonwealth. It should serve as a catalyst for a much-needed statewide discussion and effort to define and refine specific proposed actions to be pursued via policies, programs and other initiatives that can help advance an energy-enabled economy in Pennsylvania.

Phase III will involve a concerted effort from businesses, organizations and associations, and government partners to implement Phase II's Ideas for Action.

As we enter our next phase to Forge The Future of Pennsylvania with an energy-enabled growth agenda, other considerations must be acknowledged during decision-making:

- **Energy Access & Affordability:** Pennsylvanians are already feeling the benefits of low-cost gas for heating and efficient power generation. Compared to ten years ago, residential natural gas costs have fallen 57 percent to 81 percent (depending upon the utility), saving the average household $1,200 a year, according to the Public Utility Commission. In 2016, Pennsylvania consumers realized $16.2 billion in natural gas and electricity savings, compared to 2008 rates. Energy abundance, access and affordability is also an essential business cost/expense driver, which makes it a leading decision factor for potential investors, and a major influence on overall economic performance. With it, there is economic advantage; without it, there is a challenge to compete with regions where it exists. With our natural gas reserves, we have a distinct economic advantage. The same goes for NGL petrochemical products and applications.

- **Lowering Carbon Emissions:** Increased use of natural gas for power generation and heating has already had a significant impact on reducing CO2 and other emissions. From 2007 to 2015, CO2 emissions from U.S. Power Plants dropped 23 percent, driven by natural gas growth as a fuel source. This is a cleaner performing energy in a diverse mix of sources that will continue to play an important and growing role in our heat and electric power needs for many decades to come. More than a dozen efficient natural gas power plants, representing more than $10 billion in private capital investment, have either come online, or will be coming online in the near future.

- **Targeting Development and Benefits:** There must be further discussion about issues regarding the development of natural gas resources and downstream industries, including:
  - Exports versus in-state use
  - Comprehensive risk-benefit exploration of all energy sources
  - Risk-benefit examination of industrial development
  - Economic opportunity in urban areas versus more rural parts of our Commonwealth

- **Quality of Life and Environmental Stewardship:** In a world where economic benefit is often juxtaposed to environmental and/or human health risk – and sometimes presented as a false choice – technology and innovation will continue to be the forces that bring economic growth and environmental protection into closer alignment.

WITH PENNSYLVANIA'S ESTABLISHED REPUTATION FOR INNOVATION IN ENERGY, MANUFACTURING, MATERIALS SCIENCE, SOFTWARE, AND AUTOMATION/ROBOTICS, IT CAN LOOK AHEAD TO A DIVERSIFIED ECONOMY ADVANTAGED WITH ROBUST NATURAL GAS AND NGL RESOURCES. BUT, THERE IS URGENCY TO ACT, OR WE WILL LOSE OUT TO MORE AGGRESSIVE COMPETITORS. THE WINDOW OF OPPORTUNITY FOR PENNSYLVANIA TO REALIZE THE VISION OF FORGE THE FUTURE IS SHORT.

WE MUST TAKE ACTION NOW!
1. Per the Bureau of Economic Analysis, U.S. Department of Commerce
2. Per the Bureau of Economic Analysis, U.S. Department of Commerce
3. Per the Pennsylvania Department of Labor and Industry
5. Per the Department of Energy
12. “Prospects to Enhance Pennsylvania’s Opportunities in Petrochemical Manufacturing,” IHS Markit, 2017
13. Per the Marcellus Shale Coalition
14. Per the U.S. Energy Information Administration

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PARTICIPATING ORGANIZATIONS

U.S. Chamber of Commerce’s Global Energy Institute
Peoples Gas
Chevron Appalachia
Pennsylvania Manufacturers’ Association
Pennsylvania Chamber of Business and Industry
The Chamber of Commerce for Greater Philadelphia
The Allegheny Conference for Community Development
FirstEnergy
Marcellus Shale Coalition
Reserved Environmental Services, LLC
Pennsylvania Public Utility Commission
Range Resources
National Fuel Gas
Builders Guild of Western PA
International Union of Operating Engineers – Local 66
Pennsylvania Chemical Industry Council
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