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ARIZONA TECHNOLOGY COUNCIL

ARIZONA ENERGY CONSORTIUM

Powering Arizona's Future

Arizona Energy Roadmap

Developed by:

Arizona Energy Consortium

Acknowledgments

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Introduction

The development of a successful energy industry plan is a complex and enduring effort that will take patience, cooperation and strategic focus. The Arizona Energy Roadmap, developed by Arizona's energy industry, is a critical first phase in a series of actions to help Arizona develop strengths in its energy sector that will lead to future economic growth. For Arizonans, more economic growth means an increase in higher paying jobs, continued reliable low energy costs, and heightened energy self-sufficiency, among other benefits.

Imagine Arizona as the energy hub of the Southwest – where major regional transmission lines tie into infrastructure in the state and serve a growing regional demand for energy. Arizona would be a place where an increasing percentage of jobs are related to the energy industry, whether in manufacturing, generation, transmission, energy efficiency, service or technology innovation. Many of these jobs would be higher-wage jobs requiring a skilled labor force fed by Arizona's schools and universities. While there have been a number of successes in Arizona – including the nation's largest nuclear facility, the first renewable portfolio standard in the country, aggressive energy efficiency standards and positive tax incentives for manufacturing – it will be difficult, if not impossible, for Arizona to realize its place as the region's primary energy hub without a comprehensive energy policy to provide long-term direction and focus.

Arizona has a diverse energy mix but is dominated by the largest nuclear facility in the Nation and its vast fleet of coal generation. These two resources are augmented by natural gas, hydroelectric power and a small amount of solar. Arizona's coal production takes place primarily in the Black Mesa Basin and large volumes of coal move in and out of State via rail. The Glen Canyon and Hoover dams, both located on the Colorado River in the northern Arizona, provide hydroelectric power. Although Arizona is the leader in the Nation in solar power potential, its solar powered generation facilities are yet to be fully exploited. Arizona has no refineries but one is proposed for Mohawk Valley that would have capacity to refine 163,000 barrels per day of crude oil and produce 6.3 million gallons per day of petroleum clean fuels.[1]

Designed energy policies must create a stable climate for investment, be sustainable, and protect the needs of the current generation without compromising the availability of energy for future generations. Such policies should take into account "the externalities that result from energy production, delivery and consumption,"[2] while looking to maintain or increase quality of life for all Arizona residents. In addition, Arizona's energy policy should consider water use due to the aridity of our Sonoran Desert environment. With increased efforts, Arizona should strive to be a leader in the efficient use of water in power production, an area of research that is needed and can be used globally. Fully capitalizing on Arizona's resources will allow Arizona to "reduce the degree of energy imports and increase state energy exports."[3] According to the *Clean Energy Trends 2012* report, "the future looks increasingly like

it will be built off of a mix of energy efficiency, renewables, the electrification of transport, and lower carbon fuels like natural gas."[4]

The Arizona Energy Consortium (AEC) is *Powering Arizona's Future* through the Energy Roadmap utilizing a portfolio of diverse energy sources, much like an individual would utilize a diversified investment portfolio to protect against unforeseen volatility. The Energy Roadmap is a living document that will evolve with the development of the energy sector through the implementation of innovation and changes in policy. It is important that the Energy Roadmap be dynamic while providing clarity and certainty for development within the industry. Consistent with one of its key goals of collaborating with industry initiatives, the AEC will pull together the various initiatives being pursued by other organizations in the energy sector. This collaborative effort will ensure there is a united message when implementing the various goals and objectives that will make up the Energy Roadmap. As other initiatives take place, such as the Governor of Arizona's Master Energy Plan that commenced in 2013, the results will, where applicable, be incorporated into the Energy Roadmap to continue the implementation of those efforts.

Arizona's Energy Industry Vision

With a strong commitment to the long-term implementation of consistent policies supporting the energy industry, Arizona will be able to achieve the following vision over the next ten years:

> ***Arizona is the primary energy hub of the Southwest, with a diverse energy mix supporting reliable transmission and low cost energy, a strong base of manufacturing facilities, increased numbers of higher wage jobs, and world-class research institutions, resulting in increased economic development for the state and region.***

Mission

A fully realized vision, supported by consistent policies, will provide the following sustainable benefits to Arizona:

- A more diverse energy mix, including an increase of renewable energy for in-state use and export
- Enhanced energy export potential
- Heightened energy self-sufficiency and national and state security
- Increased transmission reliability
- Continued low cost energy
- Enhanced job creation and higher-wage jobs within Arizona
- Increased state economic revenue

Methodology

To achieve its mission, Arizona's energy industry must focus and excel in the following areas:

Regional Approach	Greater reliability, security, affordability and potential for new energy markets
Policy	Implementation of consistent policies supporting the energy industry, which requires meaningful collaboration among federal, state and local governments and other energy industry policy makers
Environment	Consideration and protection of Arizona's arid environment in energy generation
Messaging	Development of a cohesive narrative defining Arizona's energy industry as an enticing economic opportunity for the state, while enhancing energy self-sufficiency and national security
Finance	Policy certainty along with innovative capital structures and an effort to educate and provide greater confidence to financial markets as to the opportunities in Arizona
Incentives	Consistent and long-term production-based incentives that reward completion of projects
Permitting	Standardization and streamlining of permitting requirements and timelines to provide certainty and clarity to promote project development
Siting/Public Lands	Institution of legislative policies that better support energy generation projects on public lands
Generation	Strengthening Arizona's energy portfolio through diversification and impactful siting and permitting initiatives
Energy Clusters	Recognition that energy generation drives demand for the manufacturing industry
Transmission	Development and standardization of transmission processes to better provide Arizona access to new energy markets and more efficient use of existing transmission system
Energy Efficiency	Educational efforts to encourage energy efficiency and conservation for both residential and commercial sectors
Technology and Innovation	Elevation of Arizona's intellectual capacity to increase research and development by fostering collaboration between the private and public sectors and the universities
Transportation Fuels	Smart planning and adequate investment in transportation to help Arizona reduce its reliance on transportation fuels and stimulate regional economic growth
Workforce	Further development and expansion of a skilled energy related workforce that can meet the industry's needs
Education	Energy education programs should be integrated into Arizona's school systems with a balanced curriculum, and industry and academic institutions should work with policymakers to ensure that balanced energy education reaches all levels of government

General Considerations

A Regional Approach

Arizona is in a key geographic regional position to serve demand beyond its borders due to its lower land costs, lower cost of energy generation, pro-business governmental policies and key interconnection points. Since Arizona's energy demand is relatively small compared to some of its neighboring states, Arizona's potential should not be limited within its borders. A more robust regional approach to energy development must be adopted. Although in-state demand has reduced due to the recession, Arizona Public Service has stated in its resource plan that growth is expected to start recovery in 2014, with new generation not expected until 2017.[5] With large, high demand markets in the broader region, Arizona has a tremendous opportunity to prosper through exportation of energy generated in-state. An increased focus on a regional approach could drive an increase in renewable energy generation without requiring modification of Arizona's Renewable Energy Standard (RES).

The western states of the U.S. are blessed with vast resources. Wyoming and Arizona have tremendous amounts of coal with the coal industry accounting for 14.2% of GDP and 8% of employment during 2010 in Wyoming. The West is particularly rich in oil shale resources, with the world's largest identified reserve located in Wyoming, Colorado and Utah. Oil shale reserves in the north-central region of Utah hold approximately 77 billion barrels worth of oil that can be extracted economically with existing technology. Western states produce 69% of all U.S. natural gas, with Texas leading the states by producing 19,601,834 million cubic feet in 2011. Besides conventional energy, the West produces around 60% of all hydroelectric and solar power generation nationwide. California is the single largest producer of geothermal power in the world with capacity of 2732 MW.[6]

With a regional approach to power generation and a grid that supports the regional transmission of power, other states and nations can benefit through the development of appropriately sited generation facilities. For instance, a state in which it is more expensive to develop projects may be better served by supporting construction of generation projects in regions that have lower development costs. This would keep power pricing stable allowing the importing state to be competitive in attracting new business. With the demand in other states such as California likely to continue, as well as the retirement of coal-generating resources in the region, the generation of energy cannot be a parochial endeavor – it is essential to the prosperity of all states and nations in the Southwest that an increased focus on regional coordination be adopted.

Arizona has an opportunity to leverage the successes of its current regional development. Two existing examples of how a regional approach to Arizona's energy mix has provided reliable, affordable energy to the region include:

- The Palo Verde Nuclear Generating Station, the largest nuclear power station in the United States, is located in Arizona.[7] A portion of the energy generated by the station is transported to the California market by the Devers I transmission line.[8]

- Arizona imports essentially all of its transportation and power generation fuels from either out-of-state or from sovereign nations. Arizona has no in-state transportation fuel

resources, however as clean transportation fuels become more prevalent Arizona needs to focus on creating an in-state supply that will help alleviate this dependence.

It is also important to recognize the critical role Tribal governments play in the production and distribution of energy in Arizona and the surrounding region. In fact, almost all of the mineral-based energy resources within Arizona, particularly coal, are on tribal lands. In addition, the 2,250 MW Navajo Generating Station, which is on the Navajo Nation, is the second largest power plant in Arizona. There are also numerous natural gas pipeline segments, transmission lines for electricity and hydroelectric dams on tribal lands with[in] the state."[9] The Hopi and Diné (Navajo) lands in the Black Mesa area of Arizona hold the "largest coal deposit in the United States, with approximately 21 billion tons of coal and a long-term value as high as $100 billion."[10]

The regional importance of the electricity generation plants located on tribal lands is exemplified by several examples in or near Arizona. The Navajo Generating Station, producing over 17 million megawatt hours on an annual basis, delivers power to Arizona, Nevada and California.[11] Although the Four Corners Power Plant is located in New Mexico on the Navajo Nation near the border with Arizona, it distributes power to Arizona, New Mexico, California, and Texas.[12] Finally, the South Point Energy Center natural-gas fired merchant power plant "has the capacity to produce 540 megawatts aimed at the peak summer power demand in Arizona, California and Nevada."[13]

Although tribal governments are sovereign nations, facilities on their lands are "affected by federal energy laws and policies that have evolved over the past century, a number of which were specifically enacted to control energy resources within Indian Country."[14] New requirements for regulation of emissions imposed under laws such as the Clean Air Act impact the future of coal-fired plants such as the Navajo Generating Station. Additional emission control technology "will require substantial investment by the utilities that own the plant, and they have expressed their concerns about the costs of the most pollutant-reducing technologies proposed by EPA,"[15] and have "suggested that they might consider shutting down the plant rather than paying the costs for the new equipment. Given the significant economic reliance by the both the Hopi Tribe and Navajo Nation on revenues associated with the plant, the possibility of plant closure is a very important issue to both tribal governments."[16] The issue of plant closure is also a critical reason to develop a diverse and stable energy mix to ensure at least one source of energy is always available to avoid energy shortfalls.

Given the past number of positive results gained by regional cooperation, new efforts at regional cooperation should be implemented as new opportunities arise. All states, sovereign nations and Mexico could benefit from regional generation – whether projects are located and constructed in a particular state, or components are purchased, designed or fabricated there – as it will provide more stable energy pricing for the region and shared benefits through the delivery of energy efficiency and new generation. This message is critical to Arizona's ability to coordinate efforts on a regional energy plan, as opposed to competing with the efforts of others.

A strengthened transmission system would support greater regional exchange of energy through the use of inter-state, intra-state and cross-border generation, as further discussed in the section below on transmission. The increased capacity for regional exchange would allow certain utilities greater access to lower cost electricity and allow for trading of generation among utilities. A strengthened system will in turn provide greater energy security and continued reliability.

It is crucial that our industry leaders increase outreach to our neighboring states to better promote the benefits of interstate trade. Both the California Energy Commission[17] and the California Public Utility Commission[18] have requirements that restrict certain out-of-state renewable resources from qualifying for California's renewable target. Additionally, former CPUC Commissioner Timothy Simon has highlighted a number of items that adversely affect California's ability to meet the 33% target in a competitive manner:

1. Pricing – the expense and time of doing business in California impacts power pricing
2. Unions – impact timing of delivery and cost of projects
3. Environmental Requirements – impact timing and cost of projects in California[19]

In addition to these issues, the California Public Utility Commission continues to refine its policies related to the ability of Arizona generation projects to qualify as "in-state" for purposes of meeting the California RPS requirements.[20] Arizona should be at the forefront of this discussion to ensure more opportunities to export to this key market.

The Chairman of the Western Governors' Association (WGA), Utah Governor Gary Herbert, remarked that his chairmanship would focus on "Responsible Energy Development," with a goal of providing reliable, affordable and cleaner energy for the long term.[21] The WGA is an independent, non-partisan organization of Governors from 19 Western states, two Pacific-flag territories and one commonwealth. It was formed to identify and address key policy and governance issues in natural resources, the environment, human services, economic development, international relations, transportation and public management, and develop regional strategies to address those issues both in the short-term and long-term. Governor Herbert has confirmed the WGA's commitment to a regional approach in stating: "This initiative recognizes the critical role the West will play in achieving energy independence. We can develop our wealth of energy sources--from traditional to renewable--in responsible ways that will stimulate the economy and promote security, while protecting our natural treasures and cherished quality of life."[22] In June 2013, the WGA released the *10-Year Energy Vision*, which articulates the principal goals of Western energy policy related to energy security, affordability and reliability, environmental protection, energy efficiency, and a robust energy delivery system, as well as educational and technological development, and emphasizes the importance of having an effective federal-state partnership.[23]

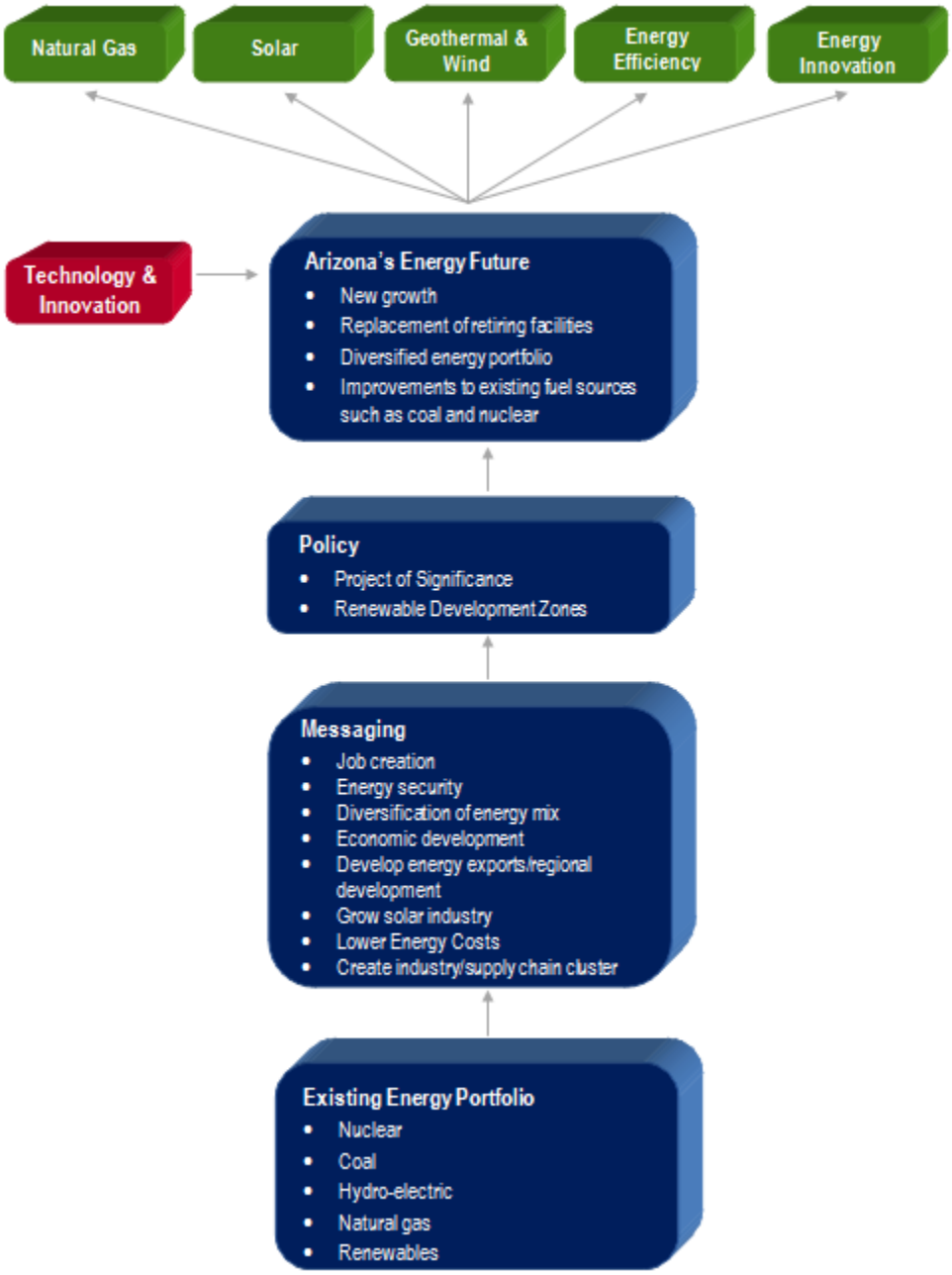
Policy Considerations

According to the *2013 U.S. Clean Tech Leadership Index*[24] that evaluates the states with respect to technology, policy and capital, Arizona is ranked 16th in the nation. This ranking is concerning given Arizona's vast solar resources and leading academic institutions. Implementation of a number of key policy initiatives would improve Arizona's ranking.

Consistency and certainty in policy are crucial to developing and sustaining any industry. When addressing energy policy goals, a focus on the health of Arizona's citizens and the preservation of its resources is paramount. Some immediate steps to provide certainty in the energy industry in Arizona could include:

1. Streamlining permitting for large-scale generation and transmission projects through such mechanisms as a “Project of State Significance” program or expansion of Renewable Development Zones
2. Expanding structures such as Property Assessed Clean Energy (PACE), Master Limited Partnerships (MLPs) and Real Estate Investment Trusts (REITs) to fund renewable energy, energy efficiency and other energy resources
3. Embracing regional development
4. Building out/improving access to transmission
5. Expanding production-based incentives
6. Providing better access to federal and state land for project development
7. Developing a professional career-based workforce development program focused on moving beyond simple job creation to developing a relevant educational linkage for highly skilled technology and project professionals
8. Maintaining policies that recognize the impacts of advanced energy generation resources such as renewables on economic development and public health in Arizona
9. Developing robust renewable energy delivery standards focused on long-term system reliability
10. Removing redundancies and inefficiencies in permitting

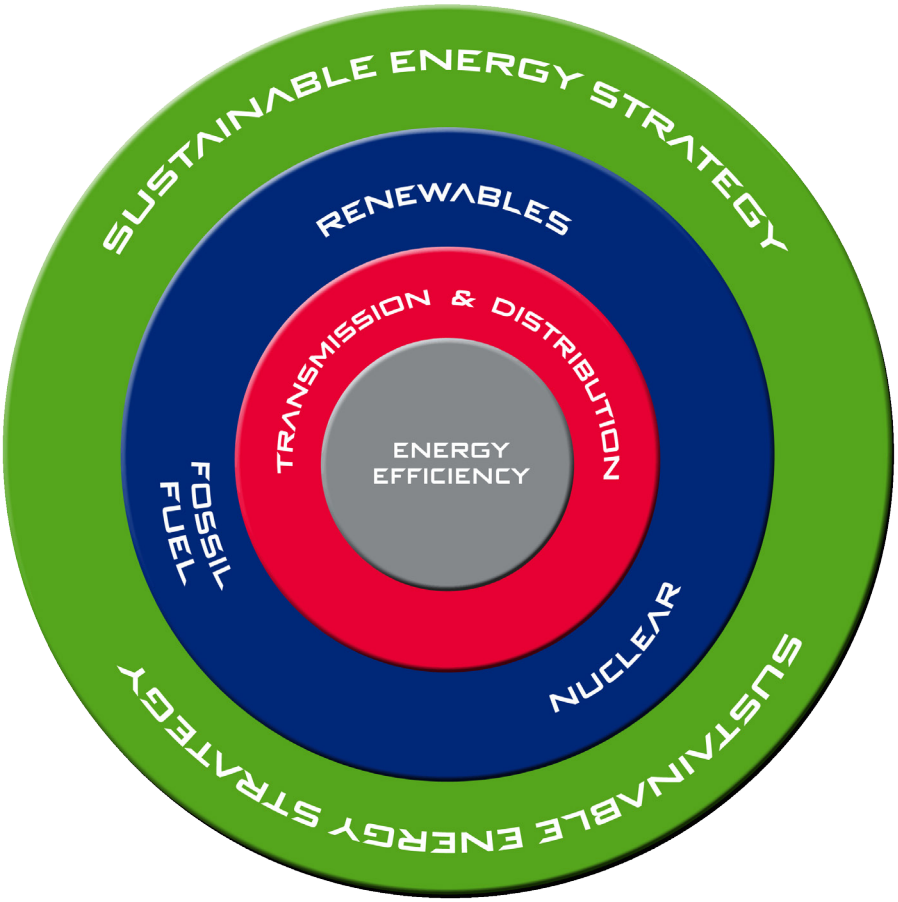
The diagram below sets forth the essential components of a sustainable energy industry:



Environment

When addressing energy policy goals, a focus on the health of Arizona's citizens and the preservation of its resources is paramount. Energy must be reliable, affordable and sustainable in the long term, while ensuring natural resources are preserved. Arizona is one of the most arid regions in the United States and needs to protect its precious water reserves. A balancing act is required when developing energy generation, transmission, fuels and manufacturing in a desert environment. It is important that any effort to enhance the energy ecosystem must be completed in a manner that does not adversely affect due process or overburden limited resources, such as water.

The chart below depicts a balanced and sustainable energy strategy. Energy efficiency lessens the need for additional resources, both traditional and renewable, as well as transmission and distribution infrastructure. Therefore, support for effective energy efficiency measures needs to be at the center of a sustainable energy plan. Additionally, sufficient infrastructure for transmission and distribution is critical to support generation in key areas for manufacturing or export. Finally, a diverse energy portfolio that includes traditional fossil fuels, nuclear power and renewable energy improves energy security and reliability, as discussed further in the next section.



Specific Considerations

Messaging
Diversity + Sustainability = Security

Messaging is a critical aspect of industry development, particularly because it is so closely tied to policy and provides the framework for success in the industry. Arizona's growing energy industry is not merely a solar opportunity, but includes a diverse set of energy resources. It is important to keep the messages broad, but also be aware of the political atmosphere in the state in which we live. Key messages that resonate across a broad array of stakeholders and policymakers as reasons to more fully develop the energy industry in Arizona include:

1. Job creation
2. Economic development
3. Diversification of energy generation opportunities by capitalizing on Arizona's renewable industry opportunities
4. Energy security
5. Energy export opportunities / regional development
6. Stabilized energy prices
7. Create industry / supply chain cluster through enhanced generation opportunities

The above topics are discussed and recurring themes throughout this Roadmap. The energy industry's messages must be clear and foster certainty within the industry. Only by emphasizing the key messages listed above can Arizona become an energy industry leader across all sectors, as opposed to only one area, such as solar. An industry that supports itself through job creation and economic development can be sustainable in the long-run.

Although Arizona has made progress in capitalizing on its available energy resources, the diversification of Arizona's energy mix by including solar and other renewable energy resources could be improved. To date, no cohesive narrative exists for Arizona's renewable energy industry. Without a consistent message it is difficult for affected stakeholders to support an industry that has not been able to effectively define itself as an important part of the broader energy mix. Lack of widespread coordination within the renewable energy industry has not served to benefit the external acceptance of initiatives proposed by the sector. This has been somewhat damaging to the image of the industry and its access to limited resources.

In addition, the intermittency of renewable energy production in the short term requires a diverse portfolio approach to make the energy sector a larger part of Arizona's economy. Given the appropriate support for renewable generation in Arizona, it will be a significant component of new generation. If developed as part of a broader energy plan, it can be developed along with other affordable, reliable generation methods. All forms of energy must be considered to make up a complete mix under a diverse portfolio. A clear and immediate method of diversification of our energy mix – while emphasizing the state's solar resources to address the intermittency of renewable resources – is to take advantage of Arizona's natural gas generation resources to provide an attractive in-state and export ready product. Intermittent resources augmented by natural gas can provide a firm carbon-reduced and secure power source until other utility-scale renewable options with inherent or built-in storage become available.

In addition to its other benefits, a key message for renewable energy development and energy efficiency improvement is that these efforts can be pursued to increase energy security. Energy security is a term for the interplay between energy availability and the effect on national security. The U.S. Department of Defense (DOD) is the world's largest single consumer of energy, spending about $15 billion a year and accounting for a staggering 70 percent of the entire energy use of the U.S. federal government.[25] Every dollar increase in the price of oil adds $30 million to the Navy's budget alone.[26] It is for this very reason that the US DOD has been an aggressive adopter of alternate forms of energy, which also minimize dependency on foreign sources of energy. Given Arizona's military installations, the state could play a key role in increasing energy security.

Additionally, a regional approach is critical to an effective energy development plan. Intermittent resources augmented by natural gas can provide a firm carbon-reduced and secure power source until other utility-scale renewable options with inherent or built-in storage become available. The transition to more renewables firmed by existing resources also helps provide stabilized energy costs, rather than having to build and fund entirely new infrastructure. These combined resources provide opportunities for an attractive in-state and export ready product. As more generation resources come online, it creates further opportunities to create a supply chain cluster to support the infrastructure for the new generation.

Policy
Consistency + Support = Development

In addition to a consistent narrative, policies supporting that narrative are essential to attract businesses to Arizona and support the businesses that are already located in the state. To ensure long-term viability of Arizona's energy industry, meaningful collaboration must occur at all levels among the state and local governments, the Arizona Commerce Authority, as well as industry. As previously discussed, Arizona's leadership is encouraged to reach out to neighboring states to discuss the benefits of a regional energy plan.

Policy decisions overlap among many areas and therefore have a vast impact for the long-term development of an industry. Several specific examples of programs that would support policies to drive development in Arizona include:

1. Project of State Significant (POSS) – an initiative of the AEC's Project Development and Energy Infrastructure committee designed to remove redundancy and uncertainty in permitting and drive in-state investment. The ultimate goal of the program would be to highlight projects of substantial economic benefit to Arizona and elevate those projects to an expedited development track. Projects would be qualified against objective pre-determined criteria such as size, investment, number of jobs created (both construction and ongoing) and induced benefits. The program would ensure permitting, entitlements, site control and other key development requirements progressed through agency review in a timely and defined fashion, thus providing certainty around timelines to allow greater access to capital. The involvement of the public sector throughout this process may also provide a public-private-partnership (P3) opportunity where the public sector could directly benefit through the success of these projects.

2. Renewable Development Zones (RDZ) – identifies desired regions for development. Generation projects within the RDZ have fast-tracked permitting and transmission development. There are also potential tax incentives to entice projects to be sited within an RDZ.

3. Cost Recovery Mechanisms for Expedited Review – allows state agencies which do not have the resources to respond in a timely fashion by recovering outside costs for expedited review. Cost recovery mechanisms such as expedited permit review would allow developers to pay for an expedited process through the use of pre-approved consultants acting on behalf of the agency. In this case, both the state agency and the developer would benefit.

In addition to the implementation of key programs, there are several strategic areas of policy development that Arizona could pursue to support the following key industry parameters:

- Transmission – provide greater reliability, security and export potential by implementing policies that support infrastructure development in strategic areas
- Research & development – enhance the role of universities in collaboration with the private sector to increase innovation and train a future energy sector workforce
- Energy efficiency – reduce energy use and consumers' energy costs by supporting policies that incentivize energy conservation
- Public/Private Partnerships – increase access to both private and public capital through the collaboration of public and private entities in key projects Increased state tax incentives – reward successful development of projects that reach completion by providing back-end incentives
- Continued equipment manufacturing and supply chain – provide tax incentives for continued growth/expansion of the supply chain to provide infrastructure for generation projects

The policies supporting the industry must be carefully weighed against externalities. Policymakers must be cognizant that the mere suggestion of new industry structures or mandates can itself create uncertainty and therefore must be carefully considered. At the same time, it is also critical to understand national and global policy trends when planning for future development. For example, rather than a typical RPS, does it make more sense to have a target that encapsulates more realistic objectives? As industrialization inevitably continues in the United States, should we be addressing new solar and other renewables through growth in demand and the retirement of existing facilities? This modification may be more politically palatable than current RPS efforts. Given this, how should we best structure the state's RPS? The industry mindset must shift from viewing renewable generation and energy efficiency as means to satisfy an Arizona mandate to an opportunity to stimulate and enhance Arizona's economy. New business and development is attracted by consistent policy and access to capital. Arizona must adopt an energy policy conducive to both.

Finance

Certainty + Clarity = Investment

The energy industry in Arizona has been predominantly funded through out-of-state investors or the utilities through their customer rate bases. Potential investors have expressed concerns about the financial risks associated with uncertainties in the Arizona market, particularly relating to regulatory and permitting issues. The solar industry, for instance, represents unfamiliar territory for many large

investors yet to be adequately educated on development processes and timelines, as well as proper risk management associated with project development.

One of the best methods to provide a higher level of certainty to the investment community to facilitate a better flow of capital is the financial community's involvement from an early stage of project development. Unfortunately, the time horizon of most investors is considerably shorter than what is required in the energy sector and most project finance institutions are no longer active in the US. Admittedly, the project finance sector in the US has never been particularly robust. There are, however, programs that can be implemented to provide certainty in policy and clarity to investors. Options to consider include:

- Project of State Significance
- Public Private Partnerships
- Master Limited Partnerships and Real Estate Investment Trusts
- Production based incentives
- Property Assessed Clean Energy (PACE) or variation of program
- Assistance connecting investors with projects

In the case of Master Limited Partnerships (MLPs) and Real-Estate Investment Trusts (REITs) that allow tax benefits to be enjoyed by a larger investor base, federal tax code changes could enable renewables and efficiency measures to leverage the same tools that have enabled the aggressive expansion of oil and gas exploration in the United States. These initiatives have been considered for some time but have yet to be adopted. A more concerted effort to support these initiatives at all levels of Arizona government would help push the adoption of these policies.

Another option Arizona could consider is a regional infrastructure bank to leverage public and private investments for infrastructure projects. One example of such a measure is included in Oregon Governor John A. Kitzhaber's *Draft 10-Year Energy Action Plan*.[27] Utility scale solar projects and transmission are two obvious beneficiaries of such a bank. This action could be combined with the previously discussed Project of State Significance initiative for permitting. There are other infrastructure banks which have been successful in funding energy projects, such as the North American Development Bank.

Foundations, philanthropic trusts and ethical investors (which fund certain types of projects deemed to be "socially responsible") could also be pursued by Arizona's economic development groups. The venture capital community and banking community are essential for development but usually only become involved when a large portion of the risk is removed. Ethical investors, foundations and trusts act more like 'angel investors,' on a much larger scale, in that they are prepared to invest early but do not usually demand the large premiums required by other early stage investors.

Another area in the energy space that has hindered finance is lack of standards and metrics to evaluate project value from concept through O&M. Value is measurable when the financiers, developers, contractors and owners of projects can make valid comparisons based on robust industry wide standards for performance, yield and reliability.

Incentives
Production Based + Clarity = Generation

Arizona's industry leaders must consider advocating for production-based (or back-end incentives) where metrics are used to require a certain level of project development or completion to better ensure success. Incentives should be implemented to reward success, as tested by some of the Arizona utilities' incentive programs that only pay out when the power is generated. The incentive provides the 'carrot' but should not provide the 'fuel' as was the case with Solyndra. Incentives provide the necessary framework to foster economic development in the form of job creation. However, Arizona must be careful not to incentivize an industry that cannot survive without incentives. It is also important to ensure that development is cost-effective and that the effect on customers is carefully considered.

The financial sector is reluctant to rely on incentives when policies are uncertain or inconsistent. This was evidenced by the federal investment tax credit (ITC) that resulted in development being stalled while there was debate surrounding the 1603 tax grant versus the ITC. An expansion of the production based tax incentives and the research and development tax credit at the state level would encourage continued growth in generation.

Policy and incentives that focus on generation are likely to positively impact the manufacturing sector. As discussed further below, Arizona must create demand to drive the energy clusters and resultant manufacturing opportunities. Incentivizing the manufacturing sector in isolation will not provide for a robust energy cluster, as has been evidenced by recent lay-offs at high profile solar panel manufacturing facilities. Policymakers must ensure that Incentive programs and tax incentives work effectively to be sustainable in the long-term.

Permitting
Clarity + Timeliness = Development

Capitalizing on Arizona's renewable resources is important, but the permitting issues the state chooses to address must benefit all forms of energy generation. While Arizona's permitting process is superior to some of its neighbors, lack of permit standardization and frequent redundancies for varying regulatory districts still hinders the attraction and completion of projects in Arizona. Arizona's permitting procedures often involve multiple go-between entities for processing, increasing the length of time necessary for project completion that can hinder access to capital.

Permitting is intrinsically tied to policy. Arizona has an opportunity to leverage its pro-business environment by removing much of the redundancy in the permitting stage of development. POSS and RDZs would act as mechanisms to resolve many of the permitting issues associated with large scale generation. The Arizona Governor's Solar Energy Task Force is currently focused on permitting for smaller-scale distributed energy to remove redundancy in the project development and transmission permitting processes. The *Gila Bend Solar Field Overlay Zone* (SFOZ) represents an example of facilitated permitting procedures. Gila Bend's SFOZ permitting process takes approximately thirteen weeks for completion[28] and allows for "at risk submittals of plans," as well as "at risk grading and drainage approval."[29] This increased focus on streamlined permitting for solar energy projects should be applied to all areas of Arizona's energy industry.

One example Arizona may consider is a program from Virginia where it has prioritized development of a facilitated permitting process for renewable projects. Since 2009, the "Virginia General Assembly enacted legislation directing the Department of Environmental Quality (DEQ) to develop regulations . . . in the form of 'permits by rule' . . . for the construction and operation of renewable energy projects of 100 megawatts and less."[30] The 'permit by rule' regulation "seeks to streamline and facilitate the development of small renewable energy projects in Virginia, and to protect natural resources."[31] This type of permit regulation "specifies uniform, across-the-board standards for all projects."[32] The permit by rule for solar projects became effective on July 18, 2012.[33]

Siting / Public Lands
Accountability + Participation = Development

Similar to permitting, project siting is directly tied to policy. Arizona has a vast amount of open arid land that would be suitable for large scale energy development, including on state-owned lands. In April 2012, the Arizona State Land Department (ASLD) and Arizona Public Service announced the first solar facility to be built on ASLD lands, the 35-megawatt APS Foothills Solar Plant.[34] While there have been some recent improvements and successes to the process in the last several years, there is always the opportunity to provide better access to state land by streamlining that process.

The ASLD would benefit from considering a model similar to the land agencies in Texas. The exploration and sale of oil has significantly enhanced the Texas economy and made the Texas education system the envy of other states. Taking better advantage of Arizona's resources, particularly solar, could produce similar results in Arizona, especially given that proceeds generated through ASLD are used to fund the state education system.

In the case of ASLD, changes must be constitutional or legislative in nature. Options that would encourage development include:

- Requiring enforceable timelines for agency action
- Removing the auction process for energy generation projects on state land
- Incorporating and enforcing achievable milestones on developers to protect ASLD's interests
- Extending lease terms to mirror oil and gas leases; if producing power, the lease term would continue
- Allowing production-based leases to ASLD to better share in the success of the project

Generation
Demand + Development = Generation

Given electrons know no state boundaries, and must be consumed when produced (without effective storage), a regional approach to generation is both logical and efficient. This approach not only provides the least expensive access to power, it provides security through geographically dispersed resources while relieving pressure on the currently over-extended grid. A regional approach does not only include Arizona's direct neighboring states but also Mexico and the entire Southwest region. Arizona's ability to provide consistency in rates is crucial for large commercial energy consumers. Historically, Arizona's utilities have provided access to low cost, reliable power for its consumers.

Arizona still heavily relies on conventional energy sources, such as coal, natural gas, and nuclear power for primary electricity generation. Additionally, according to the US Energy Information Administration, Arizona generated 2.1% of its electricity from non-hydro renewable resources in 2012.[35]

Generation can be divided into two categories: utility scale (or centralized) generation and distributed generation (DG). Utility scale power generation has been the backbone of our energy infrastructure since the transmission grid became the means for transportation of energy. As US citizens continue to consume large amounts of energy, utility scale power generation will maintain its prevalence. DG refers to power generated on the consumer's side of the grid and is more localized in nature. DG has been growing in its deployment due its modularity, can be sized to the particular need, and has the ability to displace some of the peak demand.

Energy efficiency measures and distributed generation localize power production and remove the need for some future utility scale generation, the bulk of generation will remain utility scale, however, due to its ability to meet the overall demand of the system in a cost effective manner, not just a portion of the demand profile. As certain states continue to reduce or eliminate their reliance on coal resources, utility-scale projects will be required to meet the needs of such large scale displacement.

Energy Clusters
Generation + Demand = Supply Chain Cluster

A supply chain tied to power production will only grow as demand for generation increases. Demand for generation will *always* continue to grow over the long-term. Thus, it is generation that will drive the development of supply chain cluster to supply components for generation infrastructure. An example of this fact is the recent delay in the First Solar manufacturing facility, where decreased power demand affected the pace of its completion.

Currently, solar energy is a growing market which should be leveraged both in Arizona and regionally. Several requirements must be met, however, in order for Arizona to increase the development of its solar manufacturing sector. These include a focus to drive new generation in the region, attracting innovative companies to metropolitan areas in Arizona, investing in training programs for the creation of a skilled workforce and developing the state's supply-chain to build a robust manufacturing sub-sector.[36] A heightened solar manufacturing emphasis will stimulate job creation and attract capital for future solar development projects. Furthermore, an increase in Arizona's manufacturing efforts will drive down component costs, especially in the solar industry.

Transmission
Policy + Demand = Transmission

Transmission is critical to providing secure and reliable electricity. As discussed further below, load growth shifts direct impact the development of transmission. Due to the cost and length of time required to construct transmission lines, the lack of availability of transmission infrastructure is closely tied to permitting risks associated with project development. It is imperative that Arizona invest and display leadership in the coordinated and strategic development of transmission lines to allow the energy industry to continue to prosper. A regulatory climate that provides certainty will facilitate the influx of private capital into this area of need. Furthermore, Arizona's export potential cannot be fully realized until this constraint is adequately addressed.

In order to ensure future transmission development, Arizona must:

- Identify strategic paths for transmission development to meet future demand
- Provide clarity in policy to enhance financial investment
- Capitalize on any federal programs that are available (such as the Transmission Infrastructure Program (TIP)/Sonoran-Mojave Renewable Transmission (SMRT) Project through Western Area Power Administration)
- Continue to engage Arizona's neighboring states and Mexico in the planning and development of cross border (inter-state and international) transmission

Although Arizona has made a number of progressive policy efforts to increase its future generation capability, current in-state demand still appears to be the driver for strategic siting of transmission. The Seventh Biennial Transmission Assessment[37] ("Seventh BTA") evaluates the ten-year transmission plans filed with the Arizona Corporation Commission ("ACC") to assess the current and long-term adequacy of Arizona's transmission system throughout the ten-year timeframe. In its 2012 report, the ACC Staff found that the "principal driver for transmission plans filed by the utilities in the Seventh BTA is load growth and reliability of supply to customers (e.g., "reliability-driven" projects)."[38] As a result, "the statewide demand forecast [for the 2012-2021 ten year planning period] has shifted by about six years since the Sixth BTA. This is two years longer than the shift that was observed between the Fifth BTA and Sixth BTA, and is indicative of the continuing impact of the national economic recession on electrical demand."[39] The above demand forecasts took into account distributed generation and energy efficiency, and thus "the main factor behind the drop in the forecast from 2010 to 2012 is the impact of the continuing economic recession."[40]

The reduction in Arizona's load growth highlights the need to capitalize on export opportunities in markets with higher demand. The Seventh BTA found that:

> Developing Arizona's vast renewable resource potential and export opportunities requires a coordinated and multi-faceted strategy involving stakeholders representing utility, government, economic, developer, environmental, and other interests. In particular seams issues [including differences in the electric energy market models, scheduling and congestion management protocols, planning, licensing, ownership and operational control of transmission facilities that cross state boundaries] between Arizona and California pose challenges to major growth in renewable exports. In this regard Staff and KEMA note that [FERC] Order 1000 encourages improved regional planning and cost sharing processes and we conclude that it would be beneficial for the Commission to monitor progress on seams issues that occurs as a result of Order 1000 implementation efforts in the WestConnect region.[41]

It was specifically the focus of the Order 1000 "on improved regional planning and cost sharing processes will address key seams issues related to system expansion."[42] As Arizona exceeds attainment of its current renewable generation goals, it is important to look toward new markets. Arizona can capitalize on the states (and Mexico) in our region that has a greater demand for renewable energy generation. To increase its export capability, Arizona should heighten the development of its physical connections with California through the California Independent Systems Operator (CAISO). If approved, a line connecting Arizona's facilities directly into a CAISO delivery point similar to the Devers II line

(which was denied approval by the ACC in 2007) would facilitate the transmission of Arizona renewables to the California market. This would allow California to meet its long-term energy requirements while providing Arizona with the opportunity to further develop its renewable energy industry.[43]

As part of the State's efforts to provide supportive policies to increase the construction of new transmission lines, Arizona could issue state bonds, resulting in a reduction in transmission line construction costs.[44] Such bonds have been used in the past to fund infrastructure projects.

As proposed in the Seventh BTA, Arizona should also consider initiating an interstate/federal collaboration of transmission line development as a means to reduce time-delays within the transmission approval process.[45] Greater coordination is needed "among federal agencies in the timely processing of permit applications for development of renewable resources and transmission on federal land."[46] In addition, federal agencies "should give priority to applications for rights-of-way for transmission and generation from areas with high-quality renewable resources."[47] Arizona also needs to capitalize on all benefits available at the federal level, as has been evidenced by transmission upgrades such as the Eldorado-Ivanpah line in Nevada and the Montana to Alberta Cross-Border Tie Line (MATL Tie Line). Both are examples of states supporting development that enhances the state's infrastructure by accessing federal dollars. A more concerted effort by Arizona to coordinate with federal agencies would aid transmission expansion and reliability.

A significant step in the right direction was the March 2012 letter drafted by Arizona Governor Brewer to the Western Governors' Association, where she addressed the need for Arizona to work with its neighboring states with regard to regionally coordinating transmission. In this letter, the Governor proposed the short-term objective of coordination among "states with direct connections to the California grid to ensure compliance with California Renewable Portfolio Standard rules," namely "Nevada, Oregon, Arizona, New Mexico, Utah and possibly Wyoming."[48] Governor Brewer also outlined a long-term objective in the form of broadening the discussion surrounding the examination of "lowest cost strategies" to meet "renewable policy objectives within the Western Interconnection."[49] The Governor requested that the "Staff Council" create a subcommittee of interested states, dedicated to the research and construction of recommendations surrounding this initiative.[50] A 19-member bi-national electricity transmission task force was formed to examine transmission opportunities between the U.S. and Mexico due to the recent changes in Mexican law. On June 14, 2013, a white paper entitled "Bi-National Electricity Transmission Opportunities for Arizona and Sonora" was submitted by the Arizona-Mexico Commission Energy Committee to Governor Brewer and Sonora Governor Guillermo Padrés Elías.[51] A Declaration of Cooperation was signed by energy representatives and governors of both Arizona and Sonora to evaluate bi-national electricity transmission opportunities on an on-going basis.[52]

Energy Efficiency

Education + Finance = Implementation

Energy efficiency measures will help reduce future generation demand but their success is reliant in part on a shift in behavior. Education must be utilized to modify current habits to ensure conservation and efficiency are embraced. Use of a smart meter is one method that can aid in the education of the consumer. According to Green Building Advisor, it has been demonstrated that when consumers are shown how to change their habits in real time they generally take heed. "In most instances, energy-efficiency measures remain the cheapest source of power, averaging a cost of just 3.5 cents for each

kWh saved in the U.S., according to the Edison Foundation's Institute for Electric Efficiency."[53] "With buildings responsible for more than a third of energy use worldwide and accounting for up to 80 percent of carbon emissions in large urban environments, retrofitting the built environment should become a priority."[54] Admittedly, energy efficiency does not entirely remove the need for new generation but it does slow demand while providing cost effective savings without incentives. An example of a successful energy efficiency program is the Energize Phoenix Program, which was awarded $25 million from U.S Department of Energy and the American Recovery and Reinvestment Act. This program was used to transform 10 miles of light rail line into a green Rail Corridor. The program showcased energy efficiency and sustainability through the installation of energy-efficient systems and equipment. It not only saved energy price up to 30%, abut also created more than 2000 jobs.[55]

The benefits of energy efficiency, when communicated correctly, should be the driver rather than merely a government or utility mandate and/or incentive. Programs such as Property Assessed Clean Energy (PACE), a bond finance initiative, work in other states such as California and could be embraced in Arizona, especially because the private sector is looking to be the source of funding rather than government. It is acknowledged that modifications need to be made to the program so the lender is not subordinated. This issue is currently being developed in Arizona by several stakeholder groups.

Demand response programs can assist in avoiding costly infrastructure upgrades or peak power purchases in some instances through a smarter and more robust grid. Additionally demand response may improve reliability and maintain utility rates. Solutions that incorporate the ability to deliver both energy efficiency and demand response provide flexibility to utilities while empowering consumers to save energy. These programs can also help to balance the intermittency issues resulting from renewable integration in the grid.

With the appraisal process recognizing the link between energy efficiency and a building's value, more owners will become interested in completing energy efficiency improvements and lowering their monthly energy costs. Appraisal rules should be changed to allow for a more realistic valuation for energy efficiency. Additionally, policymakers and regulators should evaluate different methods to establish a more realistic assessment of the value of energy efficiency that includes non-energy benefits. Energy efficient buildings bring a wide range of additional benefits beyond lower energy costs, including improved indoor air quality, comfort, durability and in commercial setting an increase in productivity.

Additional efforts need to be made to increase consumer awareness of energy efficiency measures that can be utilized. The AEC has created a consumer-oriented flyer that can be utilized by the local jurisdictions to help educate consumers who are remodeling their homes or businesses. A copy of the flyer can be found at www.arizonaenergyconsortium.com .

Workforce

Marketing + Curriculum = Skilled Workforce

Both nationally and in Arizona, there are skilled workforce shortages affecting many industry sectors, including energy. The nation's construction workforce is aging and there simply are not enough young people entering the skilled trades sector of the workforce. Today, nearly one-third of all construction craftsmen are over the age of 50—and the average age is increasing every year. Due to this shortage, states are in direct competition for recruitment and retention of a diverse skilled workforce to meet

industry needs. Success will continue to be elusive and unattainable for medium and high technology, project development and manufacturing until there is a major commitment to the development of an experienced professional workforce. This requires looking beyond accepted mediocrity to break the mold of least cost thinking, planning, construction and results. It requires the best and the brightest workforce and graduates who have gathered real world experience as part of their educational path.

Arizona currently has a variety of educational and trade programs aimed to training a skilled workforce. In addition to industry programs, some of the educational entities include: Maricopa County Community Colleges, Arizona State University, University of Arizona, West-MEC, East Valley Institute of Technology, Estrella Mountain Community College. Arizona also has a variety of governmental agencies focusing directly on workforce development. These agencies must work closely with industry to identify workforce needs, as well as engaging the assistance of the educational and economic development communities.

It is not sufficient, however, to have a variety of educational and trade programs if there is no driver for student to enter those programs. One program currently being developed through the leadership of the AEC to address this issue is the Go Build Arizona program. The program called GO BUILD™ was originated by the Alabama Construction Recruitment Institute (ACRI) and marketing company BIG Communications to address this issue by educating the public regarding the construction trades in a labor-neutral manner. Under the control of ACRI, Go Build Alabama was created to help solve the problem in Alabama, where expanding auto, steel production and energy industries make the demand for a highly skilled workforce in the construction trades particularly acute. The AEC is working to bring the success of this program to Arizona where it will be tailored specifically to Arizona's needs under a Go Build Arizona program. GO BUILD™ is a marketing and promotional campaign focused on enhancing the image of the trades and informing young people, parents, educators, and others who influence career decisions, about viable futures in the construction and manufacturing industries.

Through the GO BUILD™ program, young people are directed to a webpage where interactive video shows them construction trades professionals at work, in training, and at home. In addition to the "virtual experience" offered by the website, there is a user interface where information seekers may request information and enter their personal data. This personal data becomes part of a database of those interested in the construction trades. This database is available to accredited training facilities and organizations recruiting for the construction trades. Go Build Arizona seeks to complement – not compete – with existing organizations engaged in enhancing the access and excellence of construction education, training, placement, employment and professional development programs and activities. The AEC is collaborating with those who wish to better align the supply of skilled construction workers with the demand in a labor-neutral manner by using the GO BUILD™ program. This will provide better opportunities for workers, more skilled employees for construction businesses and enhanced economic development for Arizona, the Southwest, and the nation.

Education
Information + Effective Communication = Knowledge

A balanced energy plan cannot be fully developed without the support of an energy conscious and educated community at all levels – students, teachers, industry, government and political leadership – working together to understand and develop a diverse, multi-faceted energy sector.

The core of energy education should begin early in the schools. Both federal and state programs are necessary to provide broad-based energy education on issues that face the nation, as well as issues specific to Arizona. In March 1980, the National Energy Education Day was established through a Joint Congressional Resolution in effort to address the need for comprehensive energy education in schools, a reduction of US dependence of fossil fuels, and an increased use of renewable energy technologies and energy efficiency. The National Energy Education Development ("NEED") Project was created shortly thereafter to educate students at all grade levels "about the forms of energy—heat, light, motion, sound, nuclear energy, and electrical energy—with age-appropriate, hands-on explorations that emphasize the scientific process and an application of newly gained energy knowledge to understanding energy sources, electricity generation and more."[56] The NEED curriculum provides education to teachers and students about the science of energy, renewable and non-renewable sources of energy, energy efficiency and conservation, transportation. The NEED Project partners with industry such as Walmart, PG&E, ConocoPhillips and Hawaii Energy on educational programs and projects.

Although Arizona has training and educational programs at the higher education levels, it is critical for programs such as NEED to be integrated into Arizona's school systems with a balanced curriculum educating on all forms of energy. In addition, industry and academic institutions should work with policymakers to ensure that balanced energy education reaches all levels of government. This education needs to include the benefits of the energy sector to economic development and job creation that make up a sustainable energy sector as further discussed throughout this Roadmap. The education of the energy industry is a key goal of organizations such as the AEC and should continue to be coordinated on a wide-spread basis.

Technology and Innovation
Reduced Costs + Reliability = Innovation

Technology and innovation are key factors in transforming the generation and consumption of energy. Whether you are a business striving to reduce energy costs, a power provider striving to achieve demand side and return on investment objectives, or a manufacturer of energy equipment, the uptake of technology and innovation equals progress and opportunity.

Arizona's water supply is an important technology consideration in energy generation. Although considerable research has been conducted by both private entities and the universities on low water usage technologies in Arizona, a focused technological effort must continue to be made to reduce water use in both manufacturing and generation.[57] In addition, Arizona's research sector must continue to focus on energy storage potential that will in turn allow the intermittency issues that have plagued renewable energy to be addressed.[58] An emphasis should be placed on elevating the state's intellectual capacity in the form of research and development, while also educating and building its energy related workforce. Substantial efforts made in the technology innovation sub-sector could lead to a heightened procurement of company headquarters within Arizona.

The universities play a key role in technology innovation but a greater emphasis on partnering with the private sector will result in more commercial innovation while providing greater exposure to students who are the future of this sector. Technology transfer, intern participation and intellectual property development are all areas that will see the universities become more relevant in this space if such universities can partner successfully with private industry.

Two key areas of research and development that could be expanded in Arizona's universities are:

1. Solar research for electricity and as an alternate fuel
2. Reducing the dependence on water in the power production cycle

Given Arizona's arid climate both areas of research and development are logical but they would also directly benefit Arizona and position it as a leader in solar for electricity and fuels while providing an exportable commodity that would bring greater prosperity to Arizona.

Transportation Fuels

Investment + Strategic Planning = Price Stability

Currently all of Arizona's refined fuels are sourced from out of state. Like much of the Western Region, "transportation accounts for over one-third of Arizona's energy consumption"[59], and like "the nation, relies on petroleum for approximately 94 percent of that fuel."[60] Transportation expenses make up about 15.5 percent of household income nationally.[61] On average, Arizonans spend approximately $350-$400 monthly on gasoline per household.[62] The limited number of refineries in the region as well as the increasing demand for gasoline results in greater volatility in the region. Despite the high demand in Arizona, prices still tend to be lower than California due to lower taxes on gas in Arizona. California requires a more refined, less polluting gas and has had recent refinery closures that have continued to affect prices.[63] As fuel prices rise, the cost of transportation will consume an ever larger percentage of Arizonan's budgets, highlighting the importance of more utilization of alternative fuel vehicles.

As the transportation fuel mix evolves, the Western states are positioned to be beneficiaries in the emerging alternative-fuels economy due to their abundant resources that serve as domestic sources for transportation fuels.[64] Arizona was recently awarded a U.S. Department of Energy grant to establish the first ever national algae biofuel testbed in the U.S. The Arizona testbed, ATP^3 (for Algae Testbed Public-Private Partnership), is housed at the Arizona Center for Algae Technology and Innovation at the Polytechnic campus of Arizona State University. According to Pike Research, algae-based biofuel could become a 61 million barrels a year commodity with a market value of $1.3 billion by 2020—a compound growth rate of 72 percent.[65] Additionally, the Sustainable Algae Biofuels Consortium "fueled by a $6 million grant from the U.S. Department of Energy, is testing the viability of algae as a replacement for petroleum-based fuels. Additionally, Gov. Jan Brewer a year ago issued $4 million in grants and matching funds to the industry."[66] Given Arizona's high dependence on out-of-state fuel sources, alternative fuels serve as an opportunity for Arizona to directly benefit, become more energy independent and heighten energy security.

According to the US Environmental Protection Agency, in 2011 the Gila River Indian Community in Maricopa County, Arizona is leading the way by turning cooking oil to fuel and "hopes to continue using

biodiesel to fuel their fleets as a means to reduce air pollution, reduce incidences of illegal dumping, and to find a way to recycle hard-to-manage wastes."[67]

"The City of Scottsdale began using biodiesel in 2003. One year later, the entire city fleet switched over to B20 (20% biodiesel 80% petroleum diesel). The fleet currently consists of nearly 350 diesel vehicles used by the fire, police, water, and parks and recreation departments." The Deer Valley School District in Phoenix, Arizona, began using biodiesel in 1999 following a state mandate that school districts use alternative fuel vehicles to curb air pollution. In a total fleet of 250 vehicles, 140 school buses and 5 maintenance trucks run on biodiesel. These vehicles travel 2.5 million miles annually in Deer Valley."
Many Arizonans are helping Arizona reduce its dependence on transport fuels by adopting electric vehicles (EV). The Electrification Coalition (EC), which advocates for a large-scale EV deployment, estimates that 1.9 million additional jobs will be created by 2030 nationwide if we make a significant transition from gasoline-powered cars to EVs. While the EC plan is ambitious, many U.S. companies have already added substantial jobs in the EV industry.

Arizona may consider a balanced approach encouraging job creation and economic development in this industry through targeted tax incentives for corporate and government fleets. Arizona must be careful not to create unintended consequences by promoting one part of the industry at the cost of another.

The lack of a robust transportation system is hindering state and regional economic vitality.[68] Investments in multimodal transportation for municipalities may be the most effective way to mitigate increasing costs of transportation and catalyze economic growth in the short- to medium-term. A flexible, comprehensive multimodal system is critical to the region as Arizona's population growth continues to outpace the national average. [69] Investments in transit and rail can decrease congestion and reduce regional economic risk associated with oil price shocks. In addition, proper zoning and development can encourage population density and smart deployment of the built environment allowing for increased commuting via bicycle and pedestrian, thereby reducing energy use in the transportation sector.

Through smart planning and adequate investment in transportation, Arizona can reduce its reliance on transportation fuels and stimulate regional economic growth for years to come.

Measures of Success

The Arizona Energy Consortium in conjunction with other stakeholders in the energy sector will continue to develop and coordinate the successful implementation of the Energy Roadmap. Its successful implementation can be measured by the occurrence of a multitude of specified positive outcomes within Arizona's energy industry including:

- Increased economic revenue from Arizona's growing energy industry
- Increased job creation and higher-waged salaries for the state's energy workforce resulting from increased manufacturing
- Implementation of consistent and sustainable policies to drive development
- Energy security or self-sufficiency due to a reduction in the nation's reliance on foreign energy sources and increased emphasis placed on domestic renewable and natural gas resources
- Progressive advances within the industry's technology innovation sector

- Reduced greenhouse gas emissions resulting from increased use of solar energy, energy efficiency and cleaner burning fossil fuels
- Expansion of Arizona universities' research and development
- Expansion of energy related curricula

In order to ensure the continued development and implementation of the Roadmap, the AEC will release an updated draft of the Roadmap annually with the following:

1. Identify an appropriate entity to shepherd the implementation of the Roadmap beyond the AEC and continue to ensure the continued viability of the Roadmap as a guiding document and resource for the successful satisfaction of the success milestones
2. Identify and secure appropriate funding opportunities for the implementation of the Roadmap
3. Provide updated information related to:
    a. All pertinent data
    b. Current legislative and regulatory changes
    c. Specific initiatives driving the energy sector
4. Complete periodic peer review
5. Incorporate other documents that may provide best practices to incorporate in Arizona
6. Reference and augment, where appropriate, with other prepared energy plan reports

As previously stated, the energy mix in Arizona is currently dominated by coal-fired generation, nuclear generation and natural gas. Given it is unlikely new large scale nuclear or coal will play a large part in Arizona's future (see APS[70], SRP[71], and TEP[72] resource plans), Arizona must look to further diversify its energy portfolio. Arizona has an infinite energy resource in the sun that when developed more fully will satisfy an increasing percentage of the region's energy mix. It also houses a large number of underutilized gas-powered facilities that will form a dominant part of that future if coupled with our vast solar resources. The two resources can work synergistically with the delivery of firm power with natural gas providing capacity and solar energy providing sustainable, secure and inexpensive long-term power that not only can meet the region's renewable mandates, but also can aid in diversifying the region's energy mix, regardless of mandates.

If Arizona can create a more stable environment for development through better permitting mechanisms, more attractive finance structures, improved policy, increased cross border potential and a consistent energy policy, Arizona will become a hot bed for development. This development will see new businesses, greater job growth and economic prosperity.

The Arizona Energy Consortium

The AEC is a committee of the Arizona Technology Council, currently comprised of over 300 members across diversified sectors within the Arizona energy industry. The AEC is developing a credible, member-driven voice for Arizona's growing energy industry by providing meaningful input toward the development of long-term strategic plans for statewide industry growth. In accordance with these efforts, the AEC strongly promotes both economic development initiatives and continued technological innovation across the state, including the solar energy sector.

Through the AEC's various subcommittees, the AEC is working with industry stakeholders to shepherd the plan and ensure its implementation. As certain sectors of Arizona's energy industry continue their rapid growth, the AEC will continue to support, expand and help coordinate the many positive efforts already underway in our state. The AEC's subcommittees focus on Workforce Development, Project Development & Energy Infrastructure, Public Policy and Energy Efficiency to provide both education and solutions on the many difficult issues facing Arizona's energy industry. Through real collaboration uniting the efforts of the diverse businesses and agencies that make up the energy sector, sustained economic development for Arizona resulting from increased jobs, tax revenues, and a vital new source of economy will be realized.

NOTES

[1] U.S. Energy Information Administration, http://www.eia.gov/state/?sid=AZ/, (June 2013).

[2] Arizona Town Hall, "Arizona's Energy Future, 99th Annual Town Hall, Background Report Prepared by Arizona State University," (November 6-9, 2011) [portions of the report have since been updated].

[3] Id.

[4] Ron Pernick et al, Clean Energy Trends 2012, Clean Edge: The Clean-Tech Market Authority http://www.cleanedge.com/, (March 2012).

[5] Arizona Public Service, "2012 Integrated Resource Plan." http://www.aps.com/_files/various/ResourceAlt/2012ResourcePlan.pdf, (March 2012).

[6] Western Governor's Association, "State of Energy in the West" Report.

[7] Arizona Town Hall, "Arizona's Energy Future" Report.

[8] Shultz, Martin and Mark Bolton, Brownstein Hyatt Farber Schreck, "The Politics of Building Transmission: The Past and Future of the Devers II Line" Presentation.

[9] Arizona Town Hall, "Arizona's Energy Future," pg. 91.

[10] Id.

[11] Id. at 94.

[12] Id.

[13] Id.

[14] Id. at 92.

[15] Id. at 96.

[16] Id.

[17] California Energy Commission, Renewables Portfolio Standard (RPS) Eligibility Guidebook (Seventh Edition), publication #CEC-300-2013-005-ED7-CMF, adopted April 30, 2013, http://www.energy.ca.gov/portfolio/documents/index.html, (June 2013).

[18] CPUC Decision (D.) 11-12-052, <http://www.energy.ca.gov/portfolio/documents/index.html>.

[19] Simon, Timothy, *Arizona Competitive Power Alliance Energy Conference*, (March 28, 2012).

[20] CPUC Decision (D.) 11-12-020,

http://www.cpuc.ca.gov/PUC/energy/Renewables/hot/33RPSProcurementRules.htm.

[21] Western Governors' Association. <http://www.westgov.org/component/content/article/261/404> (June 12, 2012).

[22] Id.

[23] *10-Year Energy Vision*, Western Governors' Association (June 2013).

[24] 2013 U.S. Clean Tech Leadership Index, http://www.cleanedge.com/research/leadership-index/ (June 2013).

[25] Id.

[26] "Great Green Fleet Sailing Toward SECNAV Energy Goals During RIMPAC 2012," http://www.navy.mil/submit/display.asp?story_id=68408, (July 16, 2012).

[27] Governor John A. Kitzhaber. Draft 10-Year Energy Action Plan. <http://oregon.gov/energy/pages/ten_year/ten_year_energy_plan.aspx> (June 5, 2012).

[28] Eric Fitzer, Town of Gila Bend, Arizona Energy Consortium, Arizona Solar Strategic Plan Update (June 12, 2012).

[29] Id.

[30] Virginia Department of Environmental Quality. Renewable Energy. http://www.deq.virginia.gov/Programs/RenewableEnergy.aspx, (June 18, 2012).

[31] Office of the Governor Robert F. McDonnell. Department of Environmental Quality Approves Uniform Permit Regulation for Projects. http://www.governor.virginia.gov/, (June 18, 2012).

[32] Id.

[33] Virginia Department of Environmental Quality. Renewable Energy, http://www.deq.virginia.gov/Programs/RenewableEnergy/LawsRegulationsGuidance.aspx, (July 18, 2012).

[34] "State Land Department, APS Partner on First-Ever Solar Facility to be Built on State Land," <http://www.aps.com/main/news/releases/release_692.html>, (April 3, 2012).

[35] U.S. Energy Information Administration, http://www.eia.gov/state/?sid=AZ, (July 2012).

[36] Watson, Sandra, Arizona Commerce Authority. Arizona Energy Consortium, Arizona Solar Strategic Plan Update (June 12, 2012).

[37] KEMA, Inc. Arizona Corporation Commission's Seventh Biennial Transmission Assessment (2012-2021) Staff Report, Docket No. E-00000D-11-0017, (December 12, 2012).

[38] Id. at 11.

[39] Id.

[40] Id.

[41] Id. at 80.

[42] Id. at 74.

[43] Shultz, Martin and Mark Bolton, "The Politics of Building Transmission: The Past and Future of the Devers II Line" Presentation.

[44] De Blasi, Michelle, Arizona Energy Consortium, Arizona's Solar Strategic Plan.

[45] Id.

[46] Western Governors' Association. Policy Resolution 10-15: Transmission and the Electric Power System.

[47] Id.

[48] Governor Janice K. Brewer, Governor's Letter to the Western Governors' Association (March 14, 2012).

[49] Id.

[50] Id.

[51] Arizona Governor's Office of Energy Policy, http://www.azenergy.gov/doclib/6-14-13_Bi-NatlTF-Eng-WEB.pdf, (June 2013).

[52] Arizona Governor's Office of Energy Policy, < http://www.azenergy.gov/Policy/Bi-NatlTransm.aspx>, (June, 2013).

[53] Clean Edge: The Clean-Tech Market Authority. 2012 State Clean Energy Index: Executive Summary.

[54] Id.

[55] City of Phoenix, Energy Phoenix Program, <http://www.energizephx.com/>, (June 2013).

[56] <http://www.need.org/About-NEED>

[57] PDS Consulting, PLC, Enhancing Arizona's Ability to Export Renewable Energy: Barriers and Solutions Workshop.

[58] Id.

[59] Energy Information Administration, State Energy Data System (2010).

[60] Western Governors' Association, Policy Resolution 11-13, "Fueling the Future of the West: A Roadmap for Energy Security and Environmental Stewardship."

[61] Lisa Margonelli and John A. "Skip" Laitner. The Energy Trap (2011).

[62] Id.

[63] Arizona Central News Gas Prices: AZ vs CA. 2012. Nov. 20, 2012 <http://www.azcentral.com/video/1891796462001>.

[64] Western Governors' Association, Policy Resolution 11-13.

[65] Pike Research, Algae-Based Biofuels: Demand Drivers, Policy Issues, Emerging Technologies, Key Industry Players, and Global Markets Forecasts (2010).

[66] Paul M. Ingram and Clayton R. Norman, Inside Tucson Business, "Future bright as Arizona's sun for making algae production an economic driver," (October 7, 2011).

[67] US Environmental Protections Agency, Biodiesel Activity in Arizona, 2012. <http://www.epa.gov/region9/waste/biodiesel/arizona.html >, (November 17, 2012).

[68] Arizona Department of Transportation. Report on Public Hearings: Statewide Transportation Investment Strategy (June 19, 2008).

[69] Id.

[70] Arizona Public Service, "2012 Integrated Resource Plan" http://www.aps.com/_files/various/ResourceAlt/2012ResourcePlan.pdf, (March 2012).

[71] Salt River Project, Fiscal Year 2011 Resource Plan http://www.srpnet.com/about/pdfx/ResourcePlanFY2011.pdf, (August 2010).

[72] Tucson Electric Power, Integrated Resource Planning Overview. https://www.tep.com/ doc/2012TEP-UNSE-IRPWorkshop.pdf, (November 2011).

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