Integrating Alternative Fuel Vehicles in Energy Assurance Planning:

Information, Examples, and Data Resources to Guide States

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Summary

State energy assurance planning supports a robust, secure, and reliable energy infrastructure that is also resilient. Energy assurance planners engage energy providers and stakeholders from state and local government agencies, businesses, and other organizations to reduce economic consequences, assure public safety, and provide for rapid recovery in the wake of an energy supply disruption. In the longer term, energy assurance planners work to mitigate risk to critical energy infrastructure by actions and investments that reduce consequences (human and economic) and vulnerabilities from a full range of hazards and threats. Resilient infrastructures will either not fail in the event of a disaster or the degree of damage will be lessened and the time to place it back in operation is reduced.

With the continued growth of the alternative fuel vehicle (AFV) market, particularly for flex-fuel, natural gas, and biofuel vehicles, there is an opportunity to further enhance, augment, and update state energy assurance plans and promote short- and long-term energy resiliency. Across the country, nearly 100 Clean Cities Coalitions coordinate the work of almost 14,000 AFV stakeholders nationwide[1], offering an important channel and information source for planners to better understand AFV technologies, market dynamics, and strategies to promote the use of state, local, and private AFVs in response to energy supply disruptions or other emergencies. The backdrop for these local efforts is the U.S. Department of Energy's (DOE) Clean Cities' program goal for the transportation sector: to "cut petroleum use in the United States by 2.5 billion gallons per year by 2020".[2]

With support from DOE's Clean Cities program, NASEO has engaged State Energy Offices, Clean Cities Coalitions, and other stakeholders to explore and promote the incorporation of AFVs into state energy assurance planning. NASEO's examination of the extent to which energy assurance planners currently integrate AFVs into their work resulted in the following findings:

- Of the existing energy assurance plans that do address the role of AFVs, they only do so *in a limited way.* Almost across the board, there is an opportunity to incorporate more detail in the plans that address the benefits and vulnerabilities of AFVs in energy assurance planning and stronger recommendations for realizing these benefits.
- Lack of data can be a barrier to more fully incorporating AFVs in energy assurance plans. Planners need both qualitative and quantitative data about fleets and fueling infrastructure in their state (and potentially in surrounding states) and information about how alternative fuel and vehicle

[1] U.S. Department of Energy, "Coalitions", http://www1.eere.energy.gov/cleancities/coalitions.html.
[2] U.S. Department of Energy, "Clean Cities Goals and Accomplishments", http://www1.eere.energy.gov/cleancities/accomplishments.html.

technologies work, in order to optimize the use of AFVs in the event of an emergency. There is also a need to share specific examples of how AFVs can be to respond to shortages of petroleum products to ensure that essential public service needs can be sustained.

- To access needed data and examples, energy assurance planners should engage national, state, and local stakeholders, including Clean Cities Coalitions and coordinators, with access to key data.

Using these findings as a baseline and springboard for more aggressive action by state and local planners, NASEO has developed this report in order to provide information about including or expanding the utilization of AFV in energy assurance planning. This includes the opportunities and potential challenges surrounding the deployment of AFVs in emergency fleets; and the data and information needs for a more robust inclusion of AFVs in energy assurance plans.

Introduction to Energy Assurance Planning

For over four decades, the State Energy Offices have worked to plan for and mitigate energy supply disruptions by developing, implementing, and upgrading state energy emergency response plans that are a key element of energy assurance planning. The goal of energy assurance is to achieve a robust, secure, reliable, and resilient energy infrastructure, and energy assurance planning includes a vast array of activities, which fall into three main categories[3]:

1. **Preparation and planning**: State energy assurance planners identify key assets and points of contact, design and update energy emergency response plans, train personnel, and conduct exercises that test the effectiveness of response plans.
2. **Mitigation and response**: These activities include monitoring events that may affect energy supplies, assessing the severity of disruptions, providing situational awareness, coordinating restoration efforts, and tracking recoveries. It also entails mitigating risks by investments, programs and policies that reduce consequences, vulnerabilities and enhance resiliency to a full range of hazards and threats.
3. **Education and outreach**: Energy assurance planners also communicate and coordinate with key private, local, and federal stakeholders, increase public awareness, and cultivate partnerships across sectors and jurisdictions and provide for the coordination of public and private sector response risk mitigation plans.

The impacts of state energy assurance planning can take many forms. Typically, the emergency response process requires a coordinated effort among energy services providers to keep energy flowing to critical needs, and is augmented and facilitated by local, state, and federal government as may be needed. As such, the plan development process involves intensive stakeholder engagement and results in the formation of sustained partnerships across sectors and jurisdictions, often facilitated at the state level by energy assurance planners in the State Energy Offices and other state agencies that have a role. The plan design, testing, and implementation process enables states and their regional partners to improve their recovery and restoration capabilities and shorten response and recovery times during emergencies. Finally, as energy assurance plans are updated, refined, and approved, states need to consider how they should appropriately complement the broader emergency and disaster response and homeland security initiatives, investments, programs, and policies.

[3] U.S. Department of Energy, "Enabling States and Localities to Improve Energy Assurance and Resiliency Planning," https://www.naseo.org/Data/Sites/1/documents/energyassurance/documents/EAP_Brochure.pdf.

For liquid fuels such as gasoline and diesel fuel, which pose unique challenges in emergencies, a multi-pronged approach to mitigate supply constraints can be a key to a more rapid restoration of services and a return to normal economic activity. Gasoline and diesel fuel products provide 86%[4] of the total energy needed to supply the transportation sector in the United States; however, petroleum fuel shortage contingencies are generally less developed and less regulated than in the electric and natural gas sectors.[5] In a move that underscores the importance of mitigating the risks of future fuel shortages, Secretary of Energy Ernest Moniz announced in May 2014 a decision by the U.S. Department of Energy (DOE) to establish regional gasoline reserve facilities in New York and New England.[6] More recently, the first, infrastructure-focused installment of the *Quadrennial Energy Review (QER),* a multi-year roadmap initiated by President Obama in January 2014, was released in April 2015 and has urged DOE and the Department of Defense to support fuel diversity. Among its key recommendations for modernizing U.S. energy security infrastructure in a changing global market place is to for these departments to analyze, develop, and deploy biofuels, propane, and other alternative fuels that play an important role in the country's diverse energy mix.[7] In addition, the QER highlights the importance of energy assurance planning and recommends, "Support the updating and expansion of state energy assurance plans. DOE should undertake a multi-year program of support for state energy assurance plans, focusing on improving the capacity of states and localities to identify potential energy disruptions, quantify their impacts, share information, and develop and exercise comprehensive plans that respond to those disruptions and reduce the threat of future disruptions."[8]

Benefits of Linking AFV Deployment and Effective Energy Assurance Planning

As weather-related disasters have become more frequent and disruptive to states and regional energy supplies, the role of alternative fuels in mitigating the impacts of gasoline and diesel fuel shortages are important. State and local efforts to increase market penetration of AFVs can have a positive effect on energy assurance and resiliency. Such efforts may include, for instance, vehicle fleet acquisition directives, multi-state memoranda of understanding, procurement strategies that leverage states' purchasing power, incentives for private and public fleets and customers, and/or compliance with the State and Alternative Fuel Provider Fleet Program under the Energy Policy Act of 1992 (EPAct), which requires covered fleets to acquire a percentage of AFVs annually[9]. Such efforts diversify fleets that may otherwise depend entirely on petroleum and diesel fuels, lessening their reliance on fossil fuels. During emergencies that affect petroleum supplies, these efforts can also enable response teams to tap into alternatively fueled fleets and fueling infrastructure to perform critical services without further exacerbating operations or being curtailed by the fuel shortage. Especially for states that are largely dependent on out-of-state refineries or located at the end of the petroleum supply chain (such as

[4] The National Academies, "What you need to know about energy: Transportation," http://needtoknow.nas.edu/energy/energy-use/transportation/.

[5] NASEO's 2012 report, Petroleum Shortage Supply Management: Options for States, explains in further detail the unique supply challenges affecting the liquid fuels market during a shortage. Available at: http://naseo.org/data/sites/1/documents/publications/Petroleum_Shortage_Supply_Management.pdf.

[6] "US to create gas reserves for New England, Northeast," The Boston Globe, May 2014.

[7] U.S. Department of Energy, *Quadrennial Energy Review: Energy Transmission, Storage, and Distribution Infrastructure,*" April 2015, http://energy.gov/sites/prod/files/2015/04/f22/QER-ALL%20FINAL_0.pdf.

[8] ibid, page 2-24

[9] NASEO's Transportation committee has explored many of these strategies: http://naseo.org/committee-transportation.

Michigan[10]), converting critical fleets and infrastructure to alternative fuels may offer the benefit of moving fuel sources and infrastructure closer to home base. Over the long-term and as AFVs displace traditionally fueled vehicle at large scale, lower emissions associated with the growth of cleaner-burning, fuel-efficient may lessen climate change impacts[11] and, in so doing, decrease threats to energy infrastructure and critical services.

Conversely, energy assurance planning that incorporates and highlights the benefits of AFVs can have a positive impact on AFV market penetration. In many states, comprehensive energy planning, energy assurance planning, and innovative procurement enable states to "lead by example," by accelerating the state's investment in proven, cost-effective technologies that address their economic development, cost-effectiveness, energy reliability, and environmental goals. Especially in times of emergency or petroleum price spikes, the successful coordination and deployment of these vehicles can spur private business and individual purchases of AFVs by underscoring their technical capabilities, reliability, and life-cycle cost savings in comparison to conventionally fueled vehicles.

Although the current low price of gas and diesel is believed to make AFVs a tougher sell, their diversification and resilience benefits can present a compelling business and economic case independent of the going market price for petroleum. For example, the impact of an extended power outage demonstrates this dynamic: when retail gas stations and petroleum terminals are unable to operate in the affected area drives up demand on functioning fueling stations around the perimeter of the outage. The aftermath of Superstorm Sandy, which hit the Eastern Seaboard on October 29, 2012, conjures familiar images of long lines at gas stations, odd-even rationing of petroleum supplies, and price spikes. Meanwhile, compressed natural gas (CNG) vehicle owners were reported to have had easier access to fuel supply[12] and enjoyed fairly steady prices, as the hurricane did not have a major impact on natural gas infrastructure and supplies in the Northeast.[13]

Pockets of AFV fleet activity at the state and local level are helping demonstrate the advantages of diversifying fleets and the usefulness of AFVs in emergency response, recovery, and mitigation efforts. Examples cut across several of the major commercially available alternative fuels.

> ***Natural Gas:*** Significant growth in domestic natural gas supply has sparked interest in natural gas vehicles (NGVs). Fuel comes stored in pressurized form either as liquefied natural gas (LNG) or compressed natural gas (CNG), the latter of which is more common because it is easier and less expensive to store and handle.[14] According to the Alternative Fuels Data Center, heavy-duty NGVs are widely available for purchase from U.S. original equipment manufacturers; conversely, light-duty natural gas vehicles are limited. Another option available to consumers interested in

[10] Michigan Public Service Commission, "Michigan Energy Overview," http://www.dleg.state.mi.us/mpsc/reports/energy/energyoverview/.
[11] Union of Concerned Scientists, "Half the Oil: A realistic plan to cut the United States' projected oil use in half over 20 years," 2015, http://www.ucsusa.org/sites/default/files/legacy/assets/documents/clean_vehicles/half-the-oil-savings-plan.pdf.
[12] Alternative Fuels Data Center, "Natural Gas Minibuses Help New Jersey Recovery from Hurricane Sandy." http://www.afdc.energy.gov/case/1323?text.
[13] U.S. Office of Electricity and Energy Reliability, "Comparing the Impact of Northeast Hurricanes on Energy Infrastructure." http://www.oe.netl.doe.gov/docs/Northeast%20Storm%20Comparison_FINAL_041513c.pdf.
[14] National Association of State Energy Officials and the Center for Climate and Energy Solutions, "Applying the Energy Service Company Model to Advance Deployment of Fleet Natural Gas Vehicles and Fueling Infrastructure," June 2014, http://www.c2es.org/docUploads/applying_esco_model_ngv.pdf.

NGVs is to work with qualified system retrofitters to safely convert existing gasoline or diesel vehicles for natural gas operation.[15] Existing NGV fueling infrastructure is limited, which has prompted many NGV fleets to install their own dedicated, centrally-located stations. NGV investment has offered a strong economic case for certain types of fleets; in fact, some of the most common uses for NGVs are for public transit, refuse, regional haul, and government and commercial fleets, according to data from Natural Gas Vehicles for America (NGVA).

NGVs helped cities and towns in New York, New Jersey, and Connecticut realize important energy assurance and emergency response benefits in the wake of Superstorm Sandy in 2012. Atlantic City's power restoration, debris removal, and evacuation efforts were bolstered by CNG transit vehicles and facilitated by Clean Cities Coalitions and projects.[16] In 2013, the North Shore LIJ Health System's Center for Emergency Management in Syosset, New York, invested in the country's first CNG ambulance, similarly citing the "'crippling gas shortage'" after Superstorm Sandy as an impetus behind the investment.[17] Continued growth in NGV implementation, particularly by port authorities, government and emergency fleet managers, and utilities, may offer new opportunities to deploy NGVs in emergency response and recovery.

Propane: Also known as liquefied petroleum gas (LPG) or autogas, propane is a high-octane byproduct of natural gas processing and crude oil refining. Propane vehicle fleets and consumers may take advantage of a well-established public distribution network or contract with local propane marketers to establish private fueling stations. From an emergency response perspective, propane offers a unique benefit because of its mobile onsite fueling, or "wet hosing" option. This option, (as local safety codes allow), can act as a temporary fueling arrangement when stations are out of service.[18]

Propane constitutes an important alternative fuel option for emergency responder fleets. The Sandy Springs, Georgia Police Force has opted to invest in propane autogas for its police fleets through the Southeast Propane Autogas Development Program, which is administered by the Virginia energy office and Virginia Clean Cities. The department cited propane vehicles' energy cost savings, extended engine life benefits, low emissions rates, fuel reliability, and safety benefits (as the fuel is nontoxic and nonpoisonous, and ignites at a higher temperature than gasoline) as drivers for its investment.[19]

Biofuels: The two most common types of biofuels in use for transportation are ethanol and biodiesel. Ethanol, a renewable fuel made from plant materials, is typically blended with gasoline and available as E-85 for use in flex-fuel vehicles (FFVs) and as E15 for use in model year vehicles

[15] U.S. Department of Energy, "Natural Gas Benefits and Considerations," http://www.afdc.energy.gov/fuels/natural_gas_benefits.html.
[16] U.S. Department of Energy, "Be Prepared with Alternative Fuels," September 2014. View also MotorWeek's coverage of the role natural gas minibuses played in Atlantic City's recovery after Hurricane Sandy at https://www.youtube.com/watch?v=fV4S-7sPge0.
[17] North Shore LIJ, "First-of-its-Kind Natural Gas-Powered Ambulance Debuts on Long Island," April 2013, http://www.northshorelij.com/hospitals/news/natural-gas-ambulance.
[18] National Renewable Energy Laboratory, "Costs Associated with Propane Vehicle Fueling Infrastructure, August 2014, http://www.afdc.energy.gov/uploads/publication/propane_costs.pdf.
[19] Presentation by Captain Bart Humble, Sandy Springs Police Department, at NASEO 2014 Annual Meeting: http://annualmeeting.naseo.org/Data/Sites/4/media/presentations/Mills-Casey-NASEO-Panel.pdf.

2001 and newer.[20] Low-level blends (E10, which does not qualify as an alternative fuel under EPAct) require no special fueling equipment and can be used in any conventional gasoline-powered vehicle.[21] Ethanol is blended into nearly all gasoline supplies and account for nearly 10% of the nation's gasoline supply. Like ethanol, biodiesel is also a renewable fuel and can be blended with petroleum diesel to fuel diesel vehicles; B20 and other low-level blends are more common than B100 and high-level blends.[22] When compared to petroleum, biofuels offer important considerations and benefits that support energy assurance and resiliency. For instance, biodiesel causes less damage if spilled or released to the environment and is less combustible than petroleum diesel.[23]

In Florida, the state's vulnerability to hurricanes has prompted significant investment in alternative fuels as a means to reduce risk and promote resiliency: for instance, Florida Power & Light's (FPL's) biodiesel program has resulted in the purchase of more than 500,000 gallons of B100 (pure biodiesel) annually, and the utility has made available B20 blends during petroleum supply disruptions without degrading fuel economy or driver acceptance.[24]

Electricity: All-electric vehicles (EVs), or battery electric vehicles (BEVs), use a battery to store power for the motor, and are commercially available in heavy-duty and light-duty models.[25] Hybrid electric vehicles (HEVs) and plug-in hybrid electric vehicles (PHEVs) combine a conventionally-fueled internal combustion engine with a battery-powered electric motor. HEVs use regenerative braking and the internal combustion engine to recharge.[26] PHEVs plug into an electricity source. Both HEVs and PHEVs are available as light-duty, medium-duty, and heavy-duty vehicles, and are sold both in the new car and pre-owned car markets.[27]

Madison Gas and Electric, a utility based in Wisconsin, dispatched a heavy-duty PHEV utility truck to support Hurricane Sandy restoration efforts on the East Coast. According to a report from the Wisconsin State Energy Office, "the team was able to operate the PHEV in the relief efforts, when access to conventional fuel was limited."[28] Stoughton Utilities, a municipal electric utility in Wisconsin, has shared a similar story documenting its use of a PHEV bucket truck in its efforts to provide mutual aid to Pennsylvania electric customers.[29]

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[20] Alternative Fuels Data Center, "Ethanol," http://www.afdc.energy.gov/fuels/ethanol.html.
[21] U.S. Department of Energy, "Ethanol Flexible Fuel Vehicle and Infrastructure Key Terms," http://www.eereblogs.energy.gov/cleancities/post/2013/11/19/ethanol-key-terms.aspx.
[22] Alternative Fuels Data Center, "Biodiesel Blends," http://www.afdc.energy.gov/fuels/biodiesel_blends.html.
[23] Alternative Fuels Data Center, "Biodiesel Benefits and Considerations," http://www.afdc.energy.gov/fuels/biodiesel_benefits.html.
[24] National Renewable Energy Laboratory, "Biodiesel Drives Florida Power & Light's EPAct Alternative Compliance Strategy," 2010, http://www.nrel.gov/docs/fy10osti/47952.pdf.
[25] Alternative Fuels Data Center, "All-Electric Vehicles," http://www.afdc.energy.gov/vehicles/electric_basics_ev.html.
[26] Alternative Fuels Data Center, "Hybrid Electric Vehicles," http://www.afdc.energy.gov/vehicles/electric_basics_hev.html.
[27] Alternative Fuels Data Center, "Availability of Hybrid and Plug-In Electric Vehicles," http://www.afdc.energy.gov/vehicles/electric_availability.html.
[28] Wisconsin State Energy Office, "Wisconsin Clean Transportation Program," http://www.wicleancities.org/pdfs/wctp_final_report.pdf.
[29] Stoughton Utilities, "Stoughton Utilities Responds to Hurrican Sandy," October 30, 2012, http://www.stoughtonutilities.com/homedetail.aspx?created=2012-10-30T13:30:02.5893565-07:00.

Emerging technological developments in smart grid, microgrids, and energy storage, too, are putting electric vehicles (EVs) on the radar of the energy assurance community. State energy offices, federal agencies, utility commissions, and auto manufacturers are exploring Vehicle-to-Grid (V2G) and Vehicle-to-Building (V2B) integration, investigating not only the impacts of EV charging on the electric grid but, conversely, the ability of grid-integrated vehicles to manage peak loads and store electricity generated by renewable sources.[30] Heightened public and private focus on EVs as a grid resource has been accompanied by calls for infrastructure modernization, standards, and safety protocols to ensure EVs discharge energy effectively to the grid and can be a source of power during outages. In September 2014, NJ TRANSIT announced TRANSITGRID, a major microgrid effort to supply back-up power during outages to the centralized power grid. The TRANSITGRID project includes the purchase of electric, non-revenue vehicles to be used as energy storage.[31] Similarly, in November 2014 in Los Angeles, the U.S. Air Force and Concurrent Technologies Corporation unveiled the Department of Defense's first electric vehicle fleet which, with support from the California Energy Commission, uses V2G technology to provide more than 700 kilowatts of power to the grid and enhance security.[32]

Interdependencies and Vulnerabilities Affecting Alternative Fuels

The interconnectedness of U.S. energy grids and markets requires energy assurance planners to maintain a firm understanding of the interdependencies within the energy system and the vulnerabilities produced as a result. As described in the Public Technology Institute's *Local Government Energy Assurance Guidelines,* energy infrastructure powers other critical infrastructure and markets that are vital in the energy emergency response and recovery process, and in turn depends on other sectors such as, transportation, communications, public works, and finance infrastructure to operate. Within energy systems themselves, petroleum refineries and pipeline pumping stations need electricity supply or back-up generators to operate; utility maintenance operations typically reply on supplies of diesel and gasoline; and coal shipments are typically dependent on rail transport, to name a few common interdependencies. [33]

Many energy assurance plans include a discussion of steps that the state should take when faced with a motor fuel shortage, underscoring the immense need to mitigate the severity of petroleum fuel supply disruption and its impacts on public health and the economy. For the most part, the treatment of vehicles, fleets, infrastructure, and fuel conservation measures in these sections of states' plans focus on gasoline- or diesel-powered vehicles. Potential actions that states may choose to implement during a fuel shortage: establishing petroleum set-aside measures, expanding fuel storage capacity and/or outfitting gasoline fueling stations with emergency back-up generation capacity, and maximizing fuel economy and the use of alternative fuels through fleet management measures. Such strategies showcase the state's understanding of petroleum supply vulnerability and help ensure that fuel remains reliable and accessible

[30] California Public Utilities Commission, Energy Division, "Vehicle-Grid Integration: A Vision for Zero-Emission Transportation Interconnection throughout California's Electricity System," October 2013.
[31] NJ Transit, "Governor Christie Announces NJ TRANSIT to Receive $1.276 Billion in Resiliency Funding," September 2014.
[32] California Energy Commission, "AF Tests First All-Electric Vehicle Fleet in California," November 2014.
[33] Public Technology Institute, *Local Government Energy Assurance Guidelines: Version 2.0*, June 2013.

during an emergency for the highest-priority end-users, such as police, fire, and emergency medical services (plus any other essential service providers determined by the state or other legal authorities).[34]

Increasing the use of AFVs in energy assurance plans may have the impact of shifting the state's reliance from petroleum to other alternative sources, supplies, and distribution networks of energy. While this shift offers the state the opportunity to diversify its fuel supply and reduce the impact of a petroleum supply disruptions, it may also introduce new interdependencies and vulnerabilities into the system. However, very few plans include strategies and contingencies for alternative transportation fuels in the same way as they do for petroleum supply. Especially as more states choose to integrate AFVs into their energy emergency plans for their resiliency and fuel diversification benefits, there is a heightened need to understand the vulnerabilities and interdependencies that these choices may introduce into the energy assurance process and, correspondingly, include strategies that ensure alternative transportation fuels are available for their highest-priority use during emergency situations.

One crucial consideration for energy assurance plans that incorporate AFVs is alternative refueling infrastructure access and its availability in disaster situations. The preponderance of gasoline fueling infrastructure means that in emergency situations where petroleum and electricity are in full supply, conventionally-fueled emergency fleets have access to a ubiquitous infrastructure network, even across state lines. This is not necessarily the case with AFVs. For instance, despite the extensive natural gas distribution system in place in the United States, vehicle fueling infrastructure is limited and costly, and has pushed many fleets to install their own, privately-owned and centrally-located fueling stations.[35] Logistically, this may limit the ability of NGV fleets – which sometimes include heavy-duty, haul vehicles with significant potential for serving evacuation and debris removal needs – to operate for extended periods of time in locations that are far from their fueling hub. Additionally, for almost any public or private station, extended electric power outages can cripple the ability of emergency vehicles to pump fuel, limiting even the ability of AFVs to circumvent the energy supply disruption.

To mitigate against such limitations, energy assurance planners may wish to consider fuel supply and demand contingencies that keep alternative fuels accessible for critical services. Such options may include, for example, emergency alternative fuel reserves, or higher operating inventory levels, fuel set-aside measures, calls and incentives for increased investment in fueling infrastructure, guidance to promote safe mobile fueling, and/or strategies to promote the installation of back-up generator-ready alternative fueling stations.

Another important consideration for energy assurance planners concerns the performance and reactivity of alternative fuels in emergency situations. Some alternative fuels can offer a nontoxic, cleaner-burning, and less flammable substitute for gasoline. Nevertheless, safe handling of alternative fuels in many cases is distinct from specifications regarding petroleum and diesel fuels, and of paramount importance in emergency situations that involve temperature extremes or hostile environments. This requires energy assurance plans to consider providing an expanded set of guidance and resources than they otherwise would for gasoline-powered vehicles and infrastructure.

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[34] National Association of State Energy Officials, "Petroleum Shortage Supply Management: Options for States," 2012, http://naseo.org/data/sites/1/documents/publications/Petroleum_Shortage_Supply_Management.pdf.

[35] National Association of State Energy Officials and the Center for Climate and Energy Solutions, "Applying the Energy Service Company Model to Advance Deployment of Fleet Natural Gas Vehicles and Fueling Infrastructure," June 2014, http://www.c2es.org/docUploads/applying_esco_model_ngv.pdf.

The Current Landscape of AFVs in Energy Assurance Planning

Given the technical capabilities of AFVs, the availability of alternative fuel infrastructure, and existing examples of where AFVs have been used to support emergency support functions and energy resiliency, there are significant possibilities for incorporating AFVs in state energy assurance planning. The responsibility of energy assurance plans is to ensure that strategies to AFVs in energy emergencies are accompanied by a firm understanding of the alternative fuel, its distribution network, and safety considerations.

The extent to which current energy assurance plans address AFVs is broad yet limited, underscoring a significant opportunity in future plan revisions to more fully integrate and define the role of AFVs in energy assurance and emergency response and mitigation. At least 33 states have incorporated language about AFVs into their plans, with varying degrees of specificity. The ways that energy assurance plans have addressed AFVs include:

- Recognizing the resiliency and fuel diversification benefits of AFVs;
- Highlighting potential vulnerabilities and interdependencies associated with deploying alternative fuels in emergency situations;
- Providing an inventory of existing or planned AFV fleets and fueling/charging stations within the state;
- Offering information and points of contact about state laws, policies, programs, and groups (such as Clean Cities Coalitions) related to AFVs;
- Discussing the potential impact of increased AFV demand on the state's existing electric and natural gas infrastructure, and strategies to integrate electric vehicles with grid integration programs;
- Including voluntary or mandatory measures (such as AFV purchasing requirements) that the state must implement in order to respond to or mitigate the impacts of a fuel supply disruption.

Energy assurance plans in states with diverse policy and market conditions exemplify how planners are currently addressing alternative fuels through these various lenses. For the state's 2013 Energy Assurance Plan, the Oklahoma Energy Office used Central Oklahoma Clean Cities' data in order to track public and private CNG fueling station locations and highlights its partnership with neighboring states to lower the cost of CNG vehicle purchases for state fleets.[36] Maryland's 2012 Energy Assurance Plan, developed by the Maryland Energy Administration, discusses the grid integration challenges and opportunities with EVs in great detail, concluding with recommendations to upgrade the state's grid network and promote the installation of charging stations that are capable of recognizing grid emergencies.[37] In New York State's 2012 Energy Assurance Plan, the state energy office, New York State Energy Research and Development Authority (NYSERDA) is tasked with the "implementation of energy emergency response mitigation measures", which includes technical support for state agencies and schools on alternative fuels.[38]

Below are synopses describing how other leading State Energy Assurance Plans have tackled the issue of alternative fuel vehicles and infrastructure[39].

[36] Oklahoma State Energy Office, "Oklahoma Energy Assurance Plan," 2013.
[37] Maryland Energy Administration, "Maryland Energy Assurance Plan," 2012.
[38] NYSERDA, "New York State Energy Assurance Plan," 2012.
[39] These states' Energy Assurance plans are not publicly available; however, the Energy Offices responsible for these plans have agreed to share targeted and abstracted information in support of NASEO's objective to educate State Energy Offices on the possibilities for incorporating AFVs in energy assurance and energy emergency planning.

Alabama: A section of the 2013 Alabama Energy Emergency and Assurance Plan addresses conventional motor fuels as well as alternative fuels. It describes AFVs and supply sources for ethanol (E-85). While there are no ethanol production plants in Alabama, the plan identifies plants in surrounding states as well as public and private ethanol and biofuel refueling locations in the state. The plan also notes that electric, CNG, hydrogen, and LNG are important alternative fuels that can help build the state's resiliency to potential conventional fuel shortages. The plan recommends the use of AFVs in a petroleum shortage as a voluntary conservation measure.

The plan discusses current AFV programs in the state, most notably the Energy Division's Alternative Transportation Fuels Program which encourages and promotes the use of alternative transportation fuels as a way to increase the overall efficiency of the transportation system, improve air quality, and promote energy independence and which is overseeing the development of Clean Biofuel Corridors across the state. The plan also describes the mission of the Alabama Clean Fuels Coalition (ACFC)[40], which is focused on bringing AFVs to towns and cities in Alabama. It also references the Alabama Biodiesel Incentive Program, a grant program which encourages the use of clean burning biodiesel in Alabama school buses and public fleet vehicles.[41]

Colorado: The Colorado Energy Assurance Emergency Plan incorporates AFVs as part of the Colorado Energy Office's overall mission to promote sustainable economic development by advancing the state's energy market and industry. The plan makes note of the 1,654 E85 flex fuel vehicles and 228 CNG vehicles deployed by the state fleet to provide more options in the event of a petroleum fuel shortage. It also references state AFV and infrastructure tax credits and grants through the ALT Fuels Colorado, which provides partial funding for natural gas vehicles, propane vehicles, and electric vehicles as well as compressed natural gas fueling station equipment and co-located electric vehicle charging and propane auto gas station equipment.

In addition to its Energy Assurance Plan, Colorado also developed a plan specific to liquid fuels, which serves as an emergency crisis action guide in the case of a liquid fuels shortage or disruption. While the current operational plan does not explicitly recommend the use of AFVs, future updates may their incorporation.

North Carolina: North Carolina's Energy Assurance Plan describes the use of propane and biofuels such as ethanol and biodiesel for transportation under the description of the state's energy systems. It also describes federal and State policy initiatives, including an award to the Biofuels Center of North Carolina to accelerate the production and commercialization of biofuels.

In 2004, North Carolina instituted a Petroleum Displacement Plan (PDP) to reduce the demand for petroleum in the state's vehicle fleet. The PDP is the result of two laws (S.L. 2005-276 and 2006 Senate Bill 2051, Section 1. S.L. 2005-276, Budget Provision 19.5) that require state agencies, universities and community colleges to achieve a 20% reduction or displacement of their current petroleum use by January 1, 2010. As a result of the PDP, emergency and educational vehicles are required to displace 10% of petroleum use.

Data and Information Challenges and Opportunities

[40] See www.alabamacleanfuels.org
[41] http://adeca.alabama.gov/Divisions/energy/Pages/StateEnergyProgram.aspx#Fuels

Energy assurance planners rely on stakeholder engagement and data to inform the development of state energy assurance plans. To optimize the use and coordination of AFVs in the event of an emergency, therefore, both qualitative and quantitative data about the vehicle and infrastructure market in their state (and potentially in surrounding states) is a necessity. To access needed data points, energy assurance planners should engage state and local stakeholders and inform their work using specific examples of how AFVs can be used to respond to shortages of petroleum products and ensure that essential public service needs can be met. Clean Cities Coalitions (some of which are housed in the State Energy Office) and coordinators in each state offer energy assurance planners a valuable resource and channel to engage local and private stakeholders.

While data needs may vary on a state-by-state basis, NASEO has identified a number of key data elements that would support the integration of AFVs into energy assurance planning. AFV data collection should help energy assurance planners address the following questions:

- What types of AFVs does the state have at its disposal in an emergency situation?
- How many vehicles are available?
- Who owns these vehicles?
- What type(s) of fuel are these vehicles able to run on?
- Where are these vehicles located in relation to the emergency and in relation to available fueling stations?
- What are the capabilities of these vehicles (i.e., are they able to assist in debris removal or evacuation efforts)?
- Are any special purpose vehicles (e.g., police vehicles, ambulances, etc.)?
- Does the state need special permission to access these vehicles (i.e., do they belong to a local government, private owner, or neighboring jurisdiction that is willing to mobilize its AFV fleet during an emergency), and what is the process for accessing these vehicles?
- Which entity(ies) should the state contact to gain access to and begin coordinating these vehicles?

An energy assurance plan's ability to address and document the answers to these questions *before* an emergency will have a significant impact on the state's ability to deploy AFVs effectively *during* the response and recovery stage. For this reason, education and stakeholder coordination are of critical importance as energy assurance planners collect needed data points and incorporate them into their plans. Tables 1 and 2, provided below, describe the key data elements, major data sources, and critical points of contact that would support the integration of AFVs in energy assurance planning. Additionally, Appendix A includes a data collection template that can serve as a springboard for conversations among local stakeholders, such as Clean Cities Coalitions and their partners, and state and local energy assurance planners. While each jurisdiction and energy assurance planning process may vary, the template captures some of the main data points that energy assurance planners would need to incorporate data from these various sources into their plan and, ultimately, into their states' response and recovery protocols.

Table 1: Key Data Elements for Integrating AFVs in Energy Assurance Planning

Data Point	Description/Rationale	Potential Data Sources
Number and location of AFVs *Ownership/ management of AFVs*	Data points capture the size and location of state-owned, municipally-owned, or privately-owned fleets that emergency responders may be able to use to assist in evacuation, debris removal, or other response/recovery efforts.	1. State and municipal agencies that manage AFV fleets 2. Private fleet owners 3. EPAct Fleet Information 4. Local Clean Cities Coalitions
Fuel source of	Data points capture the alternative fuel source of AFVs that may be	1. State, local, and private fleet

AFVs *Typical uses and capabilities of AFVs*	deployed in the event of an energy emergency, in addition to their typical uses and capabilities (in terms of range, efficiency, fueling needs, and ability to carry cargo).	managers 2. Alternative Fuels Data Center's Alternative Fuel and Advanced Vehicle Search
Fueling/charging locations and fuel storage	Data points pinpoint locations of AFV fueling and charging stations and other critical infrastructure. Direct engagement with owners of fueling stations can help energy assurance planners identify which stations are outfitted with back-up generation, enabling access to the fuel even during power outages.	1. Alternative Fuels Data Center Vehicle Search and Alternative Fuel Station Locator 2. NREL TransAtlas 3. DHS OneView GIS 4. Fueling station owners
Cost of AFVs	Data points support decision making and identify lifecycle costs and benefits of state, local, or private purchase of AFVs and/or fleet conversions.	1. Alternative Fuels Data Center 2. Clean Cities Coalitions
Partners and stakeholders	Data point enables energy assurance planners to engage other state and local agencies (such as departments of transportation or highway administration) and groups (such as businesses and Clean Cities Coalitions) in the energy assurance planning process.	1. State and local energy offices 2. Clean Cities Coalitions 3. Alternative Fuels Data Center
Vehicle and Fuel Safety Specifications	Information points enable energy assurance planners to understand how different types of AFVs and fuel may be safely deployed in energy emergencies and extreme situations.	1. Alternative Fuels Data Center

Table 2: Major AFV and Energy Assurance Data Sources and Contacts

Data Source	Description	Accessibility	Website
Alternative Fuels Data Center (AFDC)	AFDC datasets include alternative fuel technology and vehicle information, alternative fuel filling and charging locations by state, boundaries and population coverage of Clean Cities Coalitions, truck stop electrification facilities, and efficiency/savings estimates of AFVs by type.	Publicly available	http://www.afdc.energy.gov/ http://www.afdc.energy.gov/vehicles/search/
National Renewable Energy Laboratory (NREL) TransAtlas	The TransAtlas mapping tool uses Google Maps and customized queries to display the locations of existing and planned alternative fueling stations, concentrations of different vehicle types, alternative fuel production facilities, roads and political boundaries	Publicly available	http://maps.nrel.gov/transatlas
Department of Homeland Security (DHS) OneView GIS System	OneView is a geospatial visualization tool operated by DHS and designed for the use of homeland security partners in protecting the nation's critical infrastructure and key resources. It includes the location of fueling locations for AFVs.	Limited access by those that have been authorized to access the Homeland Security Information Network (HSIN)	https://gii.dhs.gov/oneview
Clean Cities Coalitions	The Clean Cities Coalition Contacts database includes the names, locations, phone numbers, and emails of Clean Cities coordinators. Coordinators work with local fleets to develop and implement strategic plans to reduce petroleum use in the cities and counties they serve.	Publicly available	http://www.afdc.energy.gov/cleancities/coalitions/coalition_contacts.php
Energy Assurance Planning Entities	Energy assurance planners are state and local officials who are responsible for working with energy providers and stakeholders from other jurisdictions, government agencies,	Accessible through NASEO staff by request or by contacting the State	http://www.naseo.org/members-states

	businesses, and related organizations, to reduce consequences, assure public safety, and provide for rapid recovery.	Energy office in your state.	
EPAct *Fleet Information*	DOE's State and Alternative Fuel Provider Fleet Program issues Annual Reports that provide high-level data about vehicle acquisitions, fuel use, and alternative compliance strategies used by fleets.	Publicly available.	http://www1.eere.energy.gov/vehiclesandfuels/epact/pdfs/61969.pdf
FuelEconomy.gov Guide	FuelEconomy.gov, maintained by DOE and the U.S. Environmental Protection Agency, provides fuel economy and alternative fuel vehicle information for consumers and fleets, including through its popular Find-A-Car database.	Publicly available	http://www.fueleconomy.gov/

Conclusions

The growth of the AFV market offers states the opportunity to further enhance, augment, and update state energy assurance planning, increase coordination and promote short- and long-term energy resiliency. As AFV technologies continue to evolve, and as the increasing severity and frequency of disasters pose new challenges for national, state, local, and private responders, the ability of planners to collect, understand, and incorporate information could have a significant impact of the effectiveness of the state's plan and its ability to guide the state's actions during an emergency. Enhanced coordination and targeted data exchange between energy assurance planners and Clean Cities stakeholders represents a crucial first step in this process.

Appendix A: AFV Data Collection Template

This data collection form is designed to help energy assurance planners understand and collect information about the number, types, and capabilities of alternative fuel vehicles (AFVs) that are available to support the state in responding to and recovering from an emergency event or energy supply disruption.

Question/Data Need	Response Options
Do you own or do you know of alternative fuel vehicles (AFVs) that would be available for the state's use in an emergency situation?	- Yes, my agency/organization/company owns AFVs that could be made temporally available in an emergency situation - Yes, I would like to connect you with the owner of AFVs that would be available in an emergency situation
Vehicle or fleet ownership information	- Name - Contact information - Public (state or local) or private owner - Do the state's first responders need special consent to use vehicle(s) during an emergency?
What types of AFVs are available are what are their major characteristics?	- Make, model, year, and class - Special capabilities (e.g., debris removal or ability to serve as back-up power during grid outages) - Special purposes served (e.g. police vehicles, buses and vans) - Location information, including primary storage location, major routes, installation of tracking devices, and number of vehicles available by location - Is this an EPAct Fleet Vehicle?
What type(s) of fuel can be used to operate the vehicle?	- Bi-fuel vehicle? - Flex-fuel vehicle? - Location, ownership, and back-up generating ability of public and private fueling/charging locations in the state and hour of operations
Data submitted by:	- Name - Contact information - Indicate interest in participating in future revisions or updates to state's energy assurance plan