WORKING GROUP 6: REGULATORY AND ENVIRONMENTAL POLICY ISSUES

REPORT CHAPTER – AS OF SEPTEMBER 14, 2018

1. INTRODUCTION

Environmental concerns are often presented as being in tension with the needs of the state's electrical grid and the outcomes of its electrical generation practices. While this tension can be real, it is also true that as Illinois considers the future of its electrical grid, the state may have an opportunity to bring those two policy positions closer into alignment, so that the future of the grid serves not only to provide reliable, affordable electricity to all communities in Illinois, but also to achieve the state's environmental and climate goals. The state has continued to move in this direction in recent years, shown notably by the enactment of the Future Energy Jobs Act (FEJA) in 2017, which, among other things, took steps towards formally assigning a cost to carbon emissions. The NextGrid process gives Illinois an opportunity to continue this trend and better incorporate environmental values into energy regulation. While coal and nuclear generation have long provided the vast bulk of Illinois' energy generation, under FEJA Illinois has taken steps to differentiate resources that produce carbon, like coal and natural gas, from those that are carbon free, like nuclear generation and renewables. The grid of the future can be positioned to continue this movement away from carbon intensive generation by enabling new technologies and the greater flexibility and affordability that lower-carbon approaches such as renewable energy and energy efficiency offer to customers.

Working Group 6 set out to tackle policy questions related to environmental impacts of distributed energy resources (DER), climate impacts and adaptation and mitigation, and carbon regulation; the facilitator also solicited topics for the Working Group's fourth session, and beneficial electrification was added as a topic for discussion. The Working Group explored opportunities and challenges relating to technological advances and environmental impacts and identifying regulatory and policy approaches for modernizing Illinois' grid and achieving environmental objectives. To this end, Working Group 6 focused its work on four specific aspects of environmental and regulatory issues: the environmental impacts of distributed energy resources, climate and grid resiliency, beneficial electrification, and pathways to decarbonization.

To examine these subject areas, the Working Group conducted four workshop sessions. Prior to each session, a reading list of related materials was distributed by the Working Group Facilitator. The collected reading lists can be found in the included appendix. During the sessions, members of the Working Group participating in each session heard one or more presentations on the specified topic from subject matter experts, before breaking out into small groups to consider discussion questions and then reporting the results of their discussions to the entire Working Group. A full list of Working Group participants can be found below.

This chapter summarizes a broad range of viewpoints from a diverse group of stakeholders. The chapter includes the points presented in responses by those working group members who responded to a survey prior to the workshop sessions, the issues that were raised by one or more attendees at a particular workshop sessions, and, in an appendix, additional considerations raised by some working group participants through their comments on early drafts of this chapter. Again, the viewpoints expressed in the chapter are those of one or more participants and do not represent a consensus among stakeholders.

Comments made on the discussion sessions and draft versions of the report can also be found in the appendix.

2. SESSION 1: ENVIRONMENTAL IMPACTS OF DISTRIBUTED ENERGY RESOURCES

Jason Prince, of leading sustainability think tank the Rocky Mountain Institute (RMI), presented at the first working group session on environmental impacts of DER. In his presentation, RMI defined DER as "demand- and supply-side resources that can be deployed throughout an electric distribution system to meet the energy and reliability needs of the loads served by that system. [DER] can be owned by the user, a third party, or the utility, and can be used for a wide variety of applications." RMI organizes these technologies into three broad categories: distributed generation, distributed storage, and demand-side management. Distributed generation includes systems such as solar photovoltaics, combined heat and power (cogeneration) systems, diesel generators, gas-fired turbines, and fuel cells. Distributed storage includes batteries, thermal storage, and flywheels. And finally, demand-side management can include energy efficiency, demand response, and electric vehicles.

From a pure energy perspective, RMI states that these technologies can provide benefits in normal operating cost savings, infrastructure cost savings, improved power quality, and increased reliability. RMI identifies potential grid benefits, including:

- Reduced peak kilowatt (kW) demand and lower utility demand charges;
- Reduced capacity infrastructure (e.g., substation transformers) resulting from reduced peak demand;
- Reduced need for dedicated infrastructure (e.g., capacitors) from enhanced power quality;
- Reduced generation capacity required from lower peak demand; and,
- Reduced quantity and size of backup generators required.

DER can also have environmental benefits where they displace other forms of electrical generation that would otherwise provide negative health and environment impacts, such as coal- and gas-fired generation, and can help to provide resilience in the face of weather-related environmental challenges. RMI identifies the following potential environmental benefits of certain types of DER assets:

- Reduced carbon emissions;
- Reduced criteria air pollutants;
- Reduced water usage associated with energy generation; and,
- Smaller land footprint for energy generation infrastructure.

2.1 Survey Results

Prior to holding the Working Group session, the Working Group Facilitator surveyed its participants on the potential outcomes of increased adoption and deployment of DER. The survey included the following questions:

- What environmental outcomes could be served by distributed energy resources?
- What functions of the electric grid can be served by different types of distributed energy resources?
- What are the different outcomes and benefits that distributed energy resources can bring to the electric grid?

Survey responses identified the following potential environmental benefits of increased use of DER:

- Offsetting the need for more electricity generated by fossil fuels;
- Contributing to the decarbonization of the electrical grid;
- Mitigating the impacts of climate change and severe weather events;
- Reducing the peak load and offsetting the need for polluting peaker plants; and,
- Reducing air, land, and water pollution such as particulate matter, sulfur dioxide (SO2), nitrogen oxides (NOx), mercury, and other pollutants, including in, but not limited to, low-income neighborhoods.

In addition to the potential environmental benefits, survey responses identified potential benefits of widespread DER deployment to the electrical grid such as voltage support, enhanced reserves, and deferred future investments in grid infrastructure that could be costly.

The outcomes and benefits that some forms of DER could bring to the grid can be categorized into consumer benefits, system benefits, and regional grid benefits. In terms of consumer benefits, in many instances DER can reduce energy costs and increase reliability. DER can provide additional back-up power systems, if deployed as such, and thereby potentially enhance the reliability and resiliency of the grid. Additionally, in many cases DER may enable customer choice and control over what types of electrical generation a customer consumes. Growth of the DER industry can spur economic development and provide jobs as demand increases. Switching generation from fossil fuels to cleaner forms of DER can help provide cleaner air for customers and help address equity concerns.

2.2 Discussion Questions

Following a presentation from RMI, discussion participants considered the following three questions and reported the perspectives from the breakout groups to the entire meeting.

1) *"How can Distributed Solar, Energy Storage, Electric Vehicles, Energy Efficiency, Demand Response, or other technologies be used to reduce air and water pollution and achieve other environmental and grid benefits?"*

Widespread adoption and deployment of DER may significantly affect traditional generation sources and their environmental impacts. Given that most DER is or is derived from renewable energy sources, increasing the amount of DER could reduce the need for electrical generation from traditional, more carbon-intensive sources, thereby potentially reducing emissions and surface and water pollution from generation generally. To that end, DER helps to facilitate retail market decisions and policy constructs that result in a cleaner, carbon-free generation portfolio. Replacing fossil generation in this way could potentially reduce coal mining, nuclear generation, and thermal natural gas production and consumption. In turn, discussion participants suggested these changes could lead to reductions in emissions associated with transporting fossil fuels and in water consumption used for nuclear generation cooling. However, the manufacturing life cycle for DER must also be considered, as the manufacturing process could potentially also be water- and carbon-intensive, and it is unclear what the environmental impacts are of disposing of some sources of DER at the end of their lives.

As an additional benefit of DER, generating electricity near the point of consumption could reduce the peak and total demand for electricity from the grid. This could again reduce emissions and pollution, assuming the renewable energy generated by DER does not simply offset other sources of low- or no-carbon energy (both renewables and nuclear) on the grid instead of more polluting sources of energy. A smoother grid-wide consumption profile could also reduce peak capacity needs on the grid and avoid inefficiencies in the distribution of electricity and line losses that lead to unnecessary additional emissions.

In addition to the generation and demand impacts, wider DER usage, if appropriately configured, could improve the electrical grid as a whole. A significant benefit of DER adoption on the grid would be in the form of enabling greater grid resiliency and redundancy; however renewable DER is typically non-dispatchable and may be unable to consistently support these benefits. Having more electricity generated nearer the point of consumption through DER may reduce or defer some of the need for investments in improving, expanding, maintaining, and repairing transmission and distribution infrastructure. Conversely, it has been shown that DER may require additional infrastructure investment to accommodate the variability and capacity of various DER systems. Moreover, as discussed further in the Working Group's second session, to the extent that the grid needs to be upgraded to address climate change and severe weather events, DER may provide a way to do that at lower cost than building new transmission and distribution infrastructure and fortifying existing infrastructure for the existing grid. In addition to benefits, DER can also pose challenges to distribution systems that was not originally designed to host distributed resources. If DER systems do not effectively tie into the wider grid as a whole or are not reliable sources of generation, they may in fact increase the need for additional infrastructure to provide that reliability to customers, such as upgrading distribution systems. Determining not just the benefits that DER provides, but the net benefits, which considers the costs of mitigating the challenges DER can pose, is therefore part of the evaluation task. But as the distribution system changes, planning and operations, as well as assets and infrastructure, must adapt to support integration of emerging technologies and changing functions.

Other benefits resulting from DER technologies could include:

- Greater energy independence for customers;

- Additional, more flexible energy storage systems that make excess generation capacity unnecessary;
- Greater customer engagement and buy-in, leading to behavioral changes that save energy;
- Benefits associated with the electrification of the transportation sector through synergies with DER adoption (see the Working Group's third discussion); and,
- Innovation spurring additional innovation as technologies continue to develop.

When discussing the potential environmental and grid benefits of DER, the Working Group discussion participants also identified several caveats and potential hindrances to attaining these benefits. For example, when incentivizing the deployment of DER, it is important to consider three questions: who pays, how much do they pay, and what do they get for it? A major obstacle is the lack of an existing mechanism for valuing some of the benefits generated by DER. Some Working Group discussion participants, however, noted that FEJA already defines the "value of DER" at least for the distribution system and that other value streams are compensated—or could be compensated—through other mechanisms such as State Renewable Energy Credits, PJM markets and state government. The participants discussed that the lack of a policy mechanism that recognizes these individual components and rewards reductions in emissions and other pollutants slows the growth of DER as compared to traditional generation sources. Furthermore, policymakers would need to decide if such value would be decided through a command-and-control regulatory approach or a market-driven approach. Further regulatory obstacles are discussed below.

2) *<u>"What are the regulatory obstacles to capturing those benefits?"</u>*

The potential regulatory obstacles raised by participants in the working group can be roughly attributed to the following categories: friction in the regulatory structure, the lack of policy regarding carbon, opposition from existing institutions, and the lack of information.

As an initial matter, it was acknowledged that the lack of a carbon policy in Illinois or at the federal level was also discussed as an impediment to DER adoption. Without a cost associated with carbon emissions, electricity generators, distribution utilities, and customers lack incentives to reduce carbon production or chose a supplier based on reduced carbon, such as moving towards cleaner technologies and implementing additional efficiency or supply strategies. Pricing carbon could remove the incentive to externalize the cost of emissions. Similarly, if other aspects of clean electricity generation are not valued sufficiently and correctly, customers and utilities could have inadequate or incorrect information about how to value DER investments and therefore could underinvest in them. The valuation of DER can be approached using different strategies.

An aspect of the current regulatory structure that participants identified as an obstacle is friction between varying agencies and jurisdictions, such as the federal government, state agencies, and the two regional transmission organizations (RTOs) that serve Illinois, i.e. the Midcontinent Independent System Operator and PJM Interconnection. Participants described this system of fragmented, overlapping interests and regulatory goals as a "Tower of Babel" that frustrates the ability to craft a unified policy establishing consistent and accurate values for clean and traditional electricity generation difficult.

Furthermore, although the deployment of new technologies continues to occur within the existing structure of utilities and RTOs, the structure of some of these institutions can hinder the deployment of new technologies. The traditional model for distributing electricity as a "hub and spokes" model, where utilities and RTOs have distinct responsibilities with respect to generation, transmission, and distribution can present challenges to transitioning towards a "web" distribution system where electricity can be generated at many different locations and supplied to other customers on the grid on a more individualized basis.

The fourth general category of obstacles includes issues related to the lack of various kinds of information. For example, do existing incentives for deploying DER technology represent market signals accurately, or are they distorting the cost of those technologies? Furthermore, are those incentives effective in achieving their specified policy goals? Do consumers have the information that they need to make informed choices? Are there other barriers to them acting? This type of information is crucial to formulating policies that will be effective and efficient.

3) "What are options to overcome those regulatory obstacles?"

Working group discussion participants offered a wide range of potential solutions, ranging from general goals to specific policy measures. For example, some participants suggested employing rigorous cost-benefit analysis to evaluate potential policy solutions and to educate consumers and policymakers on energy solutions and challenges so they can make more informed decisions; without a full understanding of the potential value of expanding DER and awareness of the full cost of traditional, more polluting sources of electricity, customers and policymakers may be unable to make decisions that properly value the environmental benefits of DER. Working group discussion participants also discussed more specific policy actions that could be taken, such as establishing a price on carbon at the regional or federal level to encourage uniformity between the states, or through Illinois adopting a clean energy standard, or joining an existing sub-national carbon market, or perhaps establishing a state zero-emission vehicle goal. Other potential solutions included targeting investments in DER and clean energy technology in low-income communities or aligning incentives and giving customers more choices in order to encourage development and adoption of non-wires alternatives for electricity generation and distribution.

3. SESSION 2: CLIMATE AND GRID RESILIENCY

The Federal Energy Regulatory Commission defines "Grid Resilience of Bulk Power System" as follows:

> The ability to withstand and reduce the magnitude and/or duration of disruptive events, which includes the capability to anticipate, absorb, adapt to, and/or rapidly recover from such an event [....] Resilience could encompass a wide range of attributes, characteristics, and services that allow the grid to withstand, adapt to, and recover from both naturally occurring and man-made disruptive events [….]

To put this concept in context for the working group, the group heard two presentations: one on the effects of climate change from Tom Skilling, Chief Meteorologist at WGN, and the other on insurance considerations from James Breitkreitz of Zurich Insurance Group, North America.

For Illinois, the anticipated impacts of climate change will require a power grid that ensures equitable and reliable access to power in times of crisis for all communities and individuals across the state. According to Mr. Skilling, Illinois is already experiencing the disruption caused by a changing climate. For example, heavy rains and flooding have increased in recent years; the state experienced its hottest May on record in 2018, which immediately followed its coldest April in over a century. As extreme weather events become more frequent, disasters like flooding will take a toll on the state's infrastructure and its people. As shown elsewhere in the United States, large storms can cause massive disruptions, destroy communities, and claim thousands of lives, as they did in Puerto Rico, Florida, and Texas in 2017 alone. Due to climate change, the likelihood of such an event occurring in Illinois will continue to increase.

According to Mr. Breitkreitz, extreme weather phenomena directly impact the state's economy. Power outages, like those caused by heavy storms, were represented as costing the average business over $1,000 per hour of lost power. Even non-weather related natural events can incapacitate terrestrial electrical infrastructure, as Mr. Breitkreitz demonstrated with the example of coronal mass ejections. With the state's aging infrastructure, the need for new and continued investment is clear, even without the anticipated effects of climate change and extreme weather phenomena.

With these impacts in mind, investments in the grid must take into consideration the twin principles of **Climate Adaptation**—taking actions to prepare for and adjust to new conditions, thereby reducing harm or taking advantage of new opportunities—and **Climate Mitigation**, measures to reduce the amount and speed of future climate change by reducing emissions of heat-trapping gases or removing carbon dioxide from the atmosphere, such as shifting the state's generation mix to more carbon-free resources.

3.1 Survey Results

When surveyed on the specific risks and considerations for energy demand, generation, distribution, and transmission given anticipated climate impacts on Illinois's power grid, Working Group 6 survey respondents provided the following responses:

- Temperature increases, including hotter summers, more heat waves and urban heat islands;
- More extreme weather, including extreme cold/polar vortexes, greater weather event intensity/frequency and damaging winds;
- More precipitation;
- More peak air conditioning;
- Annual gross/peak energy increases;
- More use of water resources;
- Risks for essential services customers (such as first responders, water, and communications);
- Risks for vulnerable communities;
- Heat stress on equipment;
- Freezing coal piles;
- Natural gas supply constraints;
- Cooling water and thermal discharge challenges; and,
- Threats to transmission and distribution infrastructure from wind.

Respondents identified potential solutions to these risks, including:

- Ensuring appropriate grid management;
- Increasing grid flexibility and capacity to adapt;
- Developing demand response capabilities;
- Differentiated standards of service for essential services;
- Designing transmission projects to withstand extreme weather;
- Reducing reliance on large centralized, fossil-fuel powered generating stations;
- More under-grounding of distribution lines;
- Building in redundancy of power service including micro-grids;
- Greater integration of DER and more wind and solar generation (see previous section);
- Avoiding overdependence on natural gas generation;
- Investing in energy efficiency;
- Fostering innovation to meet new grid needs;
- Investing in R&D technologies to conserve energy and water resources; and,
- Educating individuals on global impacts.

Finally, the survey respondents suggested a number of steps policymakers could take to facilitate and implement the potential solutions to these challenges, including:

- Breaking down large future goals into small, manageable steps;

- Requiring integrated community and regional planning and responses;
- Incorporating climate change considerations into all grid decision-making;
- Focusing on grid modernization and reliability;
- Ensuring the effective implementation of energy efficiency and demand response programs;
- Easing policy barriers between grid operators;
- Urging grid operators to value DER and low-carbon resources properly;
- Advocating for infrastructure changes to support integration of wind and solar generation while avoiding subsidies of coal-fired generation; and,
- Requiring just transition plans for fence-line communities and workers before approving new generation.

3.2 Discussion Questions

Following the presentations, Working Group 6 participants present for the discussion considered the following three questions.

1) *"Given the climate impacts that Illinois might reasonably anticipate, what are the specific risks and considerations for demand, energy generation and grid infrastructure?"*

Participants in the discussion identified a wide range of outcomes that could be expected from Illinois's climate impacts. Many of these outcomes, if realized, could build upon each other to have compounding effects. Under a scenario where changes to the climate result in an increased frequency of extreme weather events, the grid must adapt to respond to phenomena such as hotter and longer heat waves, more intense storms and flooding, and extreme cold snap events in winter months.

These climate impacts will directly impact customers. More intense storms will result in more damage to physical infrastructure used for transmission and distribution, which could cause more frequent, sustained power outages. The costs associated with maintaining, repairing, and rebuilding grid infrastructure in response to storm damage could lead to rate increases for customers. Frequent storms could also endanger the reliability of energy generation from all sources.

Temperature extremes will result in more energy consumption for heating and cooling; for example, more customers relying on air conditioning during heat waves could in turn increase demand at peak times. More hours of peak demand would require additional capacity for generation and delivery, which may increase utilization of and costs on the transmission and distribution systems. Higher peaks could force existing power plants to run harder to accommodate the additional needed generation, which could result in additional pollution and associated health impacts, particularly in vulnerable communities. In times of crisis, this increased demand could have an outsized impact on a grid with constrained resources. Temperature extremes could also increase risks to the fuel supply of existing power plants, with cold temperatures leading to damaged pipelines or frozen coal piles, or heat-warping of roads and rail lines.

Renewable sources of generation are not immune from the effects of climate change or safety challenges: for example, installation of new solar arrays must be carried out with an understanding of the potential risks of snow and wind loading on existing buildings that were not necessarily designed to accommodate rooftop photovoltaic cells, as well as fire risk from solar arrays.

The outcomes of changes to Illinois's climate may not be strictly negative. The desire to avoid reliance on a centralized electrical grid could lead customers to embrace opportunities to install DER and to supply electricity on a more localized basis. However, for the foreseeable future, the grid will continue to play a key role in enabling the reliability, resiliency, security and other potential benefits of increased penetration of DER.

2) *"What are the potential economic, social and environmental impacts that could result from climate change impacts on Illinois' grid?"*

In terms of economic impacts, the discussion participants identified several potential costs that could result from climate change's potential effects on the grid. These include:

- Costs of repairing infrastructure damaged by severe weather events and sustained climate change;
- Costs of making resilience investments and improving transmission and distribution infrastructure;
- Costs of lost business interrupted by power loss;
- Costs of ripple effects resulting from outages; and,
- Greater impacts on vulnerable communities.

These costs could result in higher rates for customers. However, as investments in the grid are made to improve resilience under the maxim "Build Back Better," quality of service could improve, offsetting some of the increase in rates. Additional positive impacts could include new jobs and economic development associated with investing in renewable energy, energy efficiency, and a resilient grid.

More frequent or sustained grid outages resulting from climate impacts could have an impact on society in general, as lack of reliable power could prompt food and water shortages, hinder access to health care, cut means of communication, and limit the ability of essential services to operate effectively. Changes in climate and the livability of certain areas in and outside of Illinois could result in "climate refugees" as populations migrate away from regions that can no longer sustain today's population levels. Examples such as Puerto Rico show the impacts of extreme weather events on the grid; climate change could make such weather events a reality in Illinois.

Social impacts could also include increased inequity to the extent the costs associated with climate impacts fall more heavily on already vulnerable populations. This could take the form of inequity in how severe weather events affect certain populations (e.g. their housing, transportation, employment) or inequity in how investments in adaptation and resilience are distributed.

Environmental impacts could include additional pollution from existing peaker plants running harder to accommodate increased energy demand. On the positive side, changes in the climate may encourage more customers to accept and to adopt energy conservation and renewable generation, potentially making the grid cleaner and more efficient.

3) *“How can all of these risks and impacts be mitigated or addressed? And, what can policy makers and others do to facilitate and implement the potential solutions to these challenges?”*

Acknowledging that mitigation at the global level is necessary to address climate considerations, participants in the working group’s discussion suggested several potential ways of mitigating these climate-related risks and impacts in Illinois. Befitting the lengthy time horizon over which climate impacts may be felt, many potential solutions take a long-term perspective. These include educating customers and policymakers about the potential impacts of climate change on the grid and planning out future infrastructure investments with an eye for mitigating potentially larger impacts yet to come—rather than implementing short-term “Band-Aid” strategies. Other potential solutions include incentivizing DER and more extensive electrification (see later section), as well as expanding the renewable portfolio standard, adopting a clean energy standard, and establishing a fuel economy standard.

While these solutions could help build a cleaner, more efficient grid over time, some solutions could also help mitigate the effects of climate impacts on the grid. Utility rate design mechanisms and communication technologies could be configured to provide more real-time information to customers to signal changes in consumption and to potentially help offset potential increases in peak demand periods. Pricing on the wholesale market could also incorporate factors such as environmental concerns, equity, and resilience to help establish value for avoiding further climate impacts.

Working group discussion participants expressed that, in general, future grid investments should promote resilience, particularly for critical service providers, such as police, fire, and hospitals, where feasible. Public-private partnerships could make sense in some scenarios to encourage investments that would not otherwise be made. Participants in the Working Group discussion also stressed that future investments in the grid should be made with a focus on equity across communities. Finally, Illinois should continue to use state policies to address gaps in federal climate policy, through concepts like emission reduction targets or carbon pricing (see later section).

4. SESSION 3: BENEFICIAL ELECTRIFICATION

For the third session, a majority of members of Working Group 6 participating in the previous discussion sessions selected the topic of beneficial electrification. Electrification occurs when a device or service that had been powered by another fuel source is shifted to electricity, such as when an owner exchanges a gasoline-engine automobile for an electric vehicle. David Farnsworth, Senior Advisor at the Regulatory Assistance Project (RAP), characterized electrification as "beneficial" if a change provides a benefit to customers, the environment, or the grid without also adversely impacting any of those categories. For example, if substituting an electric heat pump water heater for a petroleum-burning heater provides a customer benefit in the form of lower costs over the lifecycle of the equipment, while reducing emissions (if the electric-generation mix on the grid is cleaner than burning petroleum, which it generally is now) and providing grid flexibility through energy storage and shifting demand off-peak it would be considered beneficial electrification. However, for example, if that electric heat pump water heater created new environmental concerns, increased yearly maintenance costs, or simply did not provide the same quality of service, then it would not be considered "beneficial." If the costs of low- and zero-carbon sources of energy continue to decline and advances in technologies and efficiencies at fossil fuel generating plants continue to develop, electrifying more of the energy sector could potentially yield significant benefits to customers, the environment, and the grid simultaneously, if such electrification were properly managed and deployed.

In their presentation, RAP proposed that state policy makers adhere to the following six principles for operationalizing beneficial electrification:

1) **Put efficiency first:** Maximizing energy efficiency will maximize the benefits of electrification generally.
2) **Recognize the value of flexible load for grid operations:** Greater electrification could enable the reduction of peak demand on the grid.
3) **Understand the emissions effects of changes in load:** Avoiding marginal emissions from fossil fuel sources yields environmental benefits when replaced by renewables.
4) **Use emissions efficiency to measure the air impacts of beneficial electrification:** Electrification will lead to larger reductions in emissions if the marginal generation is less carbon intensive than the existing fuel source.
5) **Measure life matters:** The lifecycle of a particular piece of equipment or technology matters when evaluating the overall benefits of electrifying that technology.
6) **Design rates to encourage beneficial electrification:** Enabling flexibility in rate design allows consumers to make choices to minimize their electric bill that are consistent with choices they would make to minimize system costs.

RAP also identifies the following steps for creating a policy framework for encouraging beneficial electrification:

- Set Goals

- Identify Barriers
- Adopt Metrics
- Recognize Timing
- Include Affected Participants
- Develop an Inclusive Process

The policy principles and process recommendations described by RAP provide insight for Illinois policymakers and stakeholders as they consider how Illinois can ensure electrification is, in fact, beneficial, and maximize those benefits.

4.1 Survey Results

Because the majority of members of Working Group 6 chose this topic to discuss during the workshop process, no survey was circulated prior to the workshop discussion.

4.2 Discussion Questions

Following the presentation from David Farnsworth of RAP, the members of Working Group 6 present for the discussion considered the following three questions.

1) *“What are the benefits Illinois might expect from pursuing a strategy of beneficial electrification?”*

In terms of environmental benefits that Illinois might expect, some discussion participants asserted that more widespread electrification could reduce emissions and improve local air quality generally, assuming that the emissions produced by Illinois’ electricity generation profile continue to decline. For example, replacing conventional combustion engine automobiles with electric vehicles will reduce the amount of gasoline or diesel burned and would minimize air pollution impact, so long as those electric vehicles are charged using relatively lower emitting generation and provided such charging is optimized to avoid increases in demand that could necessitate new generation or the use of higher emitting generation on the margin. As such, electrification of the transportation and other sectors represents a significant opportunity for reducing greenhouse gas emissions. It should also be noted that due to its large nuclear power plant fleet as well as its substantial wind resources, Illinois produces more zero emissions electricity than any other state.

Beneficial electrification could reduce financial as well as environmental costs for customers. If the total-cost-of-ownership of an electric appliance is cheaper than a functionally-equivalent appliance that uses other forms of energy, then all else equal, electrification of that appliance would reduce a consumer’s energy costs. To calculate such costs, the customer would have to consider the various times that such an appliance could be used, the actual costs of electricity compared to alternative energy costs at those times, and rate structures that would encourage use of the appliances at lower-cost times, among other considerations. With a flexible rate structure that enables and encourages greater customer choice over when and at what price to consume electricity, beneficial electrification could potentially help consumers lower their electricity bills.

Nearly all customers in Illinois currently have available to them real-time priced supply, but only a small portion of residential customers currently avail themselves of real-time prices. To potentially reap more benefits of beneficial electrification, many retail customers will need more education and information about these considerations. Another opportunity could arise from rate options in addition to real-time pricing, e.g. time-of-use rates.

Beneficial electrification could also have positive impacts on the grid generally. While electrification enhances consumer and commercial productivity, comfort, and security at potentially lower costs than current non-electric alternatives, electrification also represents new electricity demand, and thus increases the utilization of installed assets; more kilowatt-hours consumed translates to greater stability in customer delivery rates. Greater utilization of the system as a whole could lower system costs on a per kilowatt-hour basis if the greater utilization of the system is focused on hours when system resources are not stressed. Opportunities for changing the load shape and reducing peaks could also contribute to lower costs on the grid, as well as in generation. The grid could also benefit from reduced energy losses and improved resilience if clean distributed energy resources were located near these new sources of load. Investing in grid infrastructure could help utilities facilitate electrification and realize these cost benefits more rapidly, although the the costs of such investment could potentially reduce or eliminate such benefits.

Finally, investing in electrification could help make Illinois a leader in technology and a role model for other states. Electrification is not a goal just for its own sake; it supports other important goals, including decarbonization, improving productivity and efficiency, which are also key parts of grid modernization goals. EV charging infrastructure installation provides well-paying jobs and economic benefits, and technological development and additional infrastructure investments could create new jobs and stimulate economic development in the state.

2) *"What are the potential challenges to Illinois adopting such an approach?"*

Several obstacles could exist to beneficial electrification. In some cases, it may be difficult for a change to fit RAP's definition of beneficial electrification, i.e. that a change must provide a benefit to customers, the environment, or the grid without also adversely impacting any of the other categories.

One set of issues involves cost. The total-cost-of-ownership of a new appliance that runs on electricity instead of some other fuel will ideally be cheaper for a consumer to purchase and use than non-electrified options (i.e. she or he likely needs to receive some other benefit than environmental considerations in order to justify switching to that new appliance). Additionally, even if the total-cost-of-ownership justifies purchasing such a product, the consumer must have sufficient capital or access to financing in order to purchase the product, or she or he cannot switch to the electrical good. Relatedly, some products are long-lived, and it may not be cost-effective to switch to an electrical option if there is a meaningful remaining life to the existing appliance. This becomes particularly important for low- and moderate-income customers.

The upfront capital costs for new infrastructure required to upgrade the transmission and distribution system could be considerable for utilities. Depending on what is electrified where, there will be physical and operational system impacts that need to be addressed. Assuming these costs are passed on to customers, they may react negatively if they do not perceive or experience an immediate benefit. The question of who pays for infrastructure upgrades is particularly relevant through an equity lens, if electrified appliances or vehicles are adopted more broadly by affluent communities while low-income communities are left to shoulder a disproportionate share of the burden. In general, the cost impacts of enhanced electrification merit careful consideration to ensure that the associated infrastructure costs are cost-effective from an end-use customer standpoint and to ensure that such costs do not impose excessive burdens on end-use customers or on industry in Illinois, or that unfair shifting of costs does not occur.

The lack of flexibility in existing rate structures in Illinois—evidenced by the challenge of creating an equitable time-of-use rate option other than real-time pricing —could present a challenge if electrified appliances and products become more widespread. While utilities do offer an hourly price and critical peak rebate option, enrollment in the programs remains low. Customers who are on traditional flat (average) pricing will not have an economic incentive not to use their additional electrical appliances at times of peak demand. In other words, without increasing enrollment in existing time-varying rate programs or introducing new options such as time-of-use rates, more electrification could mean more demand for electricity at peak periods, leading to higher generation costs, strain on the grid, and increased emissions.

Not having an economy-wide price on carbon for all resources could also inhibit movement toward beneficial electrification. Without a carbon price reflecting costs imposed on society by greenhouse gas emissions but not currently captured by the 'market' price of coal and natural gas, the price of electricity from carbon-emitting sources or from direct fossil fuel use is artificially lower than if the social costs of carbon were incorporated into market prices. This artificial depression of prices from carbon-intensive generators may encourage electrification that would not occur if such costs were included in the price of electricity. However, it should also be noted that other energy sources receive federal or state subsidies that also artificially lower their prices. Again, the environmental benefits of electrification depend on the environmental profiles of the generation sources and the fuel from which the appliance is switched, which can be time and location specific. The recently-passed FEJA made an effort at imposing a carbon price by requiring the price of electricity from zero-carbon resources reflect the value of avoided CO2 emissions.

Assuming grid resilience and reliability is a critical consideration for policymakers (see previous section), electrifying more appliances and increasing energy demand on the grid could strain the capacity of existing infrastructure to meet that demand. On the one hand, in cases of natural disaster or other grid outages, electrification without additional grid investment could strain backup energy sources, reduce resilience, and hinder the ability to recover from a disruption. On the other hand, if the electrified appliances included storage, such as electric vehicles or water heaters, then those appliances might be able to help support localized electricity usage when the grid as a whole is unable to meet that demand due to resilience-related challenges.

3) *<u>"How can those challenges be addressed?"</u>*

Given the potential benefits that could come from beneficial electrification, Working Group 6 discussion participants identified a number of strategies that could be deployed to overcome potential obstacles.

In order to allow for maximum flexibility and give customers more control over their energy use, the state could explore more options for rate design that would align more closely with the actual costs of electricity and provide stable and predictable blocks of pricing. In addition, greater investment in energy controls and energy efficiency could make flexible rate design more feasible and customer-friendly. Working Group 4 also addresses these topics.

To encourage that electrification that occurs is indeed beneficial for the environment, a price could be imposed on carbon across all generation resources showing the true price of electricity compared to fossil fuels and encouraging additional deployment of renewable energy, energy efficiency, and demand response. Some or all of the revenues from such a program could be re-invested in efficiency programs and the infrastructure needed to support wider spread electrification (see previous section).

Consumer-facing incentives could be used to encourage customers to adopt technologies and approaches that favor efficient electrification over less-efficient, traditional technologies, such as replacing gas-powered water heaters or switching to electric vehicles. Illinois could identify the easiest targets for initial electrification in order to maximize "bang for the buck."

Low-income and environmental justice communities could be prioritized to ensure everyone receives proportionate shares of the potential benefits of electrification, instead of certain customers subsidizing the benefits of everyone else.

Illinois should be aware of potential conflict between different policy goals, such as energy efficiency requirements that aim to reduce overall load versus beneficial electrification that would likely increase overall load.

Lastly, Illinois should encourage utilities, businesses, and public institutions to invest in technologies and policies that would accelerate electrification to facilitate widespread adoption, such as electrification of vehicle fleets, rural electric vehicle corridors, community solar, building technology, and electrified autonomous/ride-share transportation options, and other non-transportation sources of fossil fuels. To the extent electrification is beneficial, such policies would help Illinois realize benefits.

5. SESSION 4: PATHWAYS TO DECARBONIZATION

David Littell, Principal at the Regulatory Assistance Project (RAP), provided background on decarbonization programs that other jurisdictions have established. Decarbonization programs can take several forms: market-based trading, such as a public or private trading market and registry, or a regulatory cap and trade program; a direct price on carbon emissions, such as an upstream or retail-level carbon tax; or other non-pricing based policies, like efficiency standards or deployment of renewably energy resources.

Mr. Littell provided background on the Regional Greenhouse Gas Initiative (RGGI), one example of a market-based decarbonization program. Over ten years and 40 allowance auctions, the states in the northeastern and mid-Atlantic regions that have participated in RGGI have reduced CO2 emissions in the power sector by more than 50 percent and raised $2.9 billion from the program to reinvest in their economies, while the states' GDPs have grown during the same period. RGGI has accelerated the transition to cleaner energy sources, with half of power generation in RGGI states now coming from low or no-carbon sources, and investments in energy efficiency programs funded by RGGI proceeds reducing electricity use and potentially helping to reduce further fossil fuel consumption. Littell reported that the program is estimated to have created $4 billion in net economic benefit and tens of thousands of new jobs. Littell also presented on other experience in decarbonization regimes, including the California-Quebec cap-and-trade system and British Columbia's carbon tax.

With these and other decarbonization programs occurring in other states and across the globe, Illinois may wish to consider how such a system might look here.

5.1 Survey Results

Prior to the workshop session on this topic, participants in Working Group 6 were surveyed on the following two questions:

- If Illinois were to put a price on carbon and other greenhouse gases through a tax or a cap-and-trade system, what information would Illinois policymakers need to have, and what factors would they need to take into consideration before developing and implementing such a system?
- If there are pollution issues that need to be addressed in addition to carbon and other greenhouse gases, what are those pollution issues and how should they be addressed?

In response to the first question, respondents of the survey provided answers that were grouped into five categories: 1) types of information that would be required; 2) regulatory structure issues; 3) economic issues; 4) environmental issues; and 5) how to spend potential revenue.

In their survey responses, participants provided the following examples of types of information that Illinois should have before regulating carbon:

- A target for the optimal level of emissions and reductions;
- Information on the availability of emissions inventory data and monitoring systems;
- A full understanding of the social, economic, public health, and environmental costs and benefits of a state carbon price;
- A measure for the damages caused by emissions and the cost of abatement;
- A definition of "environmental justice communities;"
- The extent to which an Illinois program would have jurisdiction over, or have impacts on, emissions from generating assets situated in other states;
- Any applicable lessons from California's cap-and-trade system or RGGI; and,
- General information on the regulatory regimes of other states.

Regulatory structure issues identified by the survey respondents included:

- Determining the tax level or carbon price sufficient to drive the desired reductions or to fund investments;
- Determining a desired level of emissions reductions that would allow the market to set the value of those reductions;
- Determining which activities in what geographical areas would fall under a potential cap, price, or tax, with consideration given to how an Illinois program would integrate with the PJM and MISO energy markets;
- Preventing leakage;
- Comparing the advantages of a taxing program to cap and trade;
- Setting or otherwise recognizing the appropriate value for the social cost of carbon, given the relatively low cost established under FEJA and the similarly low prices observed in the California and RGGI carbon markets;
- Determining how an Illinois program would interact with other states, given state boundaries, generation occurring out of state, and the option to join existing programs instead of creating new program from scratch;
- Deciding who would implement and administer the program; and,
- Deciding who would collect revenues, how they would be collected, and to whom or what programs the revenues would be distributed.

Economic issues included:

- What the appropriate carbon price would be and how it would be determined;
- Which customer groups would pay and how much they would pay;
- The impact of a carbon pricing program on Illinois's economy and competitiveness;
- The impact on energy-intensive industries;
- The impact on Illinois's coal production sector;
- How public-sector entities would bear a potential carbon cap, price, or tax;
- How disadvantaged populations would bear a potential tax, bearing in mind considerations of equity and environmental justice; and,

- How to spend the revenue generally.

Environmental issues included:

- The impact of a carbon price on the existing Zero Emissions Credits program and Renewable Portfolio Standard;
- The impact of the transportation sector on carbon emissions given the potential imposition of a tax;
- The possibility of encouraging zero-carbon generation instead of imposing a tax;
- The need for the electrification of transportation, heating, and other sectors to achieve deep decarbonization; and,
- Legacy issues associated with the use of coal.

And finally, responses over how to spend the revenue included:

- Refunds to consumers to offset potentially higher costs;
- Investments in energy efficiency and clean energy technologies;
- Targeting funds in environmental justice communities; and,
- General revenue.

In response to the second survey question regarding other, non-greenhouse gas pollution issues that would need to be addressed, survey respondents identified pollutants in water and other solid wastes, hazardous air pollutants (such as mercury), criteria air pollutants (particulates, ozone, SO_2, NO_x, etc.), impacts from the whole lifecycle of renewable and storage technology, carbon embedded in products brought into Illinois, and air pollution from trucks in low-income neighborhoods. As mechanisms to address those other pollutants, survey respondents identified the following potential measures: market programs, prioritization by the utilities of using clean generation, creating recycling and disposal policies, phasing out diesel generation at backup generators in favor of backup storage, and focusing on reducing other emissions with the reduction of CO_2 as a side benefit.

5.2 Discussion Questions

After Mr. Littell's presentation on market and regulatory pathways to decarbonization, Working Group 6 discussion participants considered the following three questions and provided the following perspectives. The discussion was facilitated by Clinical Professor of Law Mark Templeton, Director of the Abrams Environmental Law Clinic at the University of Chicago.

1) *"Given the considerations required in establishing a system for pricing carbon emissions, what are the benefits Illinois might expect from such an approach?"*

Participants in the discussion identified numerous potential benefits that could result from Illinois establishing a price on carbon. Lowering carbon emissions through a pricing mechanism would likely result in cleaner air for Illinois, as well as cleaner water, healthier communities and healthier individual Illinoisans because incentivizing reductions in greenhouse gas emissions would also be anticipated to lead to reductions in co-pollutants. A price on carbon could result in more investments in renewable energy and energy efficiency.

Pricing carbon could also have significant economic impacts. The drive to lower emissions could spur technological innovation, leading to developments in energy efficiency, electric vehicle technology, and other cost-effective and scale-able technologies—creating jobs and increasing investments in the state. Communities might be able to benefit from a healthier environment and from investments that would be possible with new revenue streams from pricing carbon emissions.

A state carbon-pricing policy could also heighten public awareness of the effects of emitting carbon. Through both its effect on prices and simply by raising the salience of carbon impacts, it could lead to residents of the state making decisions in their homes and communities that better protect the environment from carbon impacts.

Finally, a state carbon-price could result in opportunities for Illinois to assume a leadership role in this policy field, either as a partner in collaboration with other jurisdictions already pursuing similar policies, or as a model for other states who are considering such an approach.

2) *What are the potential challenges to Illinois adopting such an approach?"*

While the impacts on a particular participant in the state's economy could be positive, negative, or neutral, the overall economic impact of a prospective carbon pricing policy in Illinois is unknown. Although evidence in other jurisdictions indicates the potential for economic growth for the state, the uncertainty surrounding potential negative economic outcomes—such as increased energy costs and customer rates, worker dislocation, or other negative impacts on the state's economic competitiveness—could be an obstacle to Illinois policymakers establishing such a system in the state or a reason not to pursue such a policy. Whether or not such negative impacts would actually occur is not entirely clear.

Political resistance could also arise from disagreements over how to spend any new revenue collected and concerns about whether the revenues would actually be applied to the intended purposes. Likewise, doubts over the ability of a state-level program to ensure both system-wide and local public health benefits could generate political reticence towards creating a new program.

Concerns about impacts on low-income and environmental justice communities would need to be addressed. For example, without other limitations or enforcement efforts, a market-based approach could increase emissions—or not decrease them—in environmental justice communities. Increased electricity prices could also negatively affect low-income communities and other Illinois ratepayers if there is not a corresponding rebate of carbon fees to consumers.

Higher prices could also cause energy-intensive businesses to move jobs and tax dollars out of the state.

Policy and market integration and coordination with other regional entities may create obstacles for an Illinois-specific carbon pricing policy. Coordinating with grid operators and regional energy markets could create additional costs for such a program, while a lack of consistent policy with other surrounding states or the federal government could diminish the effectiveness of the program's carbon reductions and hinder the state's economic competitiveness as compared to its neighbors if not properly addressed.

3) *"How can those challenges be addressed?"*

The participants of the working group discussion examined a range of strategies to address challenges that might arise if Illinois seeks to implement a carbon pricing program. Illinois could draw from the experiences of RGGI and California to avoid potential pitfalls when crafting its own program. Furthermore, if Illinois were to pursue a carbon pricing program, it could choose to become part of an already functioning program instead of trying to establish a new one. Even if Illinois chooses to create its own program, enlisting its neighboring states to take on a regional, broad-based approach potentially could help the state avoid some economic and administrative challenges, such as movement of industry from Illinois to other states.

In order to avoid problems and to mitigate potential negative impacts of pricing carbon, the state should consult early and often with affected stakeholders, including but not limited to all relevant state, federal and regional regulators, utilities, industry groups, ratepayer advocates, municipalities, environmental organizations and environmental justice communities, to ensure a new policy choice does not disproportionately negatively impact certain segments of the state's population and the business community or any other group of utility customers. By engaging various stakeholder groups early in a dynamic, inclusive policymaking process, the state could increase its chances of creating a sustainable, successful program. There could be opportunities to use revenues from the program in targeted ways to mitigate further any negative impacts of the program, in the form of customer rebates or transition planning for affected communities.

Setting clear policy goals for a new program in advance might also help Illinois navigate any challenges that arise in its implementation. A potential carbon cap or tax could initially cover a single, specific sector of the carbon-emitting economy to give program administrators an opportunity to evaluate how the program is working and to make modifications before expanding the reach of the program, while reconciling the effects of a program with other environmental initiatives, such as beneficial electrification. An independent entity could be engaged or created to help monitor the program, could provide relevant metrics to measure the efficacy of a carbon price on local and statewide carbon and other impacts, and could make recommendations to improve the program. The program could consider how to integrate efficiently with renewable portfolio, energy efficiency, and zero emissions standards and the REC markets to maximize the collective benefit and minimize duplicative costs of these policies.

Some participants cautioned that before Illinois makes any commitment to the implementation of new environmental initiatives such as carbon pricing or grid modernization investments, there must be careful vetting of the economic impacts of these policies to identify potential negative ramifications which could include higher end-use customer electricity costs, cost shifting among customer classes, and harm to the competitive position of Illinois industry particularly relative to industry in neighboring states. It was suggested that such an evaluation should include detailed cost-benefit analysis, using a recognized methodology that does not predetermine the outcome and considers the need for cost caps, to insure that these policies produce benefits for Illinois end-use customers in excess of their costs. Such a review of the impacts of any grid modernization or environmental initiatives on the power sector could insure that before policymakers make such decisions, they are aware of and consider whether such policies impose substantial additional cost burdens on end-use electricity customers and whether cost burdens are shifted unfairly to large industrial customers, which would lead to cross-subsidization and potentially violating the principle of setting rates based on cost causation.

Finally, those participating in the working group discussion suggested that a public educational campaign would be necessary to clearly articulate to the public why a carbon pricing program is being implemented, how it would affect individuals and communities, and how revenues from the program are being spent. Such an effort could help reassure the public and ensure the long-term viability of the system.