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Good morning and thank you for this opportunity, Chairman Murkowski and Ranking Member Cantwell. I'm honored to contribute once again.

I am here today in my role as analyst for Bloomberg New Energy Finance, a division of financial information provider Bloomberg LP. Our group provides major investors, utilities, policy-makers, and others with data and insights on what we define as new energy technologies. These include renewables such as wind and solar, electric vehicles, energy efficiency technologies, power storage systems such as batteries, and natural gas, among others. My remarks today represent my views alone, not the corporate positions of Bloomberg LP. And of course, they do not represent specific investment advice.

Before I get to my main points, a quick note about "infrastructure". In the current climate, this term has become a Rorschach test of sorts representing different things to different constituent groups. In the case of energy, infrastructure can encompass a broad scope, including, among other things, building power-generating facilities, expanding oil and gas distribution pipelines, or hardening local power grids.

Those topics are worthy of discussion and I know my fellow panelists will shed light on them. However, my testimony today will focus on the next generation of energy technologies and the infrastructure that will be critical to accommodate them.

The US is transforming how it generates, delivers, and consumes energy. These

changes are fundamentally empowering business and home owners, presenting them with expanded choices and control. Consumers today can, for instance, analyze and adjust their heating, air-conditioning, and electricity use over their smart phones thanks to smart meters and smart thermostats. And they can make efficiency improvements through advanced heating and cooling systems and innovative building materials and techniques.

Consumers in much of the country can choose their electricity supplier and may opt for “green choice” plans. They can produce power themselves with rooftop solar photovoltaic systems. They can even store it locally with new batteries.

Consumers can choose to drive vehicles propelled by internal combustion engines, electric motors, or some combination of both (hybrids). That car can be powered by gasoline, diesel, electricity, ethanol, or perhaps even methanol, natural gas, or hydrogen. And electric vehicle drivers who own homes can turn their garages into fueling stations simply by using the outlet on the wall.

Now, realistically speaking, few Americans today have the inclination or income to become high-tech energy geeks. But that is changing as prices associated with these technologies plummet. In the case of electric vehicles (EVs), such cars can be appealing simply because they perform better.

We at BNEF believe that further growth and eventual mass adoption of these technologies is not possible, not probable, but inevitable given rapidly declining costs.

For instance, the price of a photovoltaic module has fallen by 90% since 2008, to approximately $0.40 per Watt today. For millions of US businesses and homeowners, “going solar” is already an economic decision. Last year the US installed far more solar

generating capacity than it did any other technology.

By the end of the next decade, cost competitiveness for distributed solar will arrive most places in the US – without the benefit subsidies. We expect the current installed base of US solar to grow from approximately 3.6% capacity to 13% by 2030 then to 27% by 2040.

Similarly, the value of contracts signed to procure US wind power have dropped by approximately half as the industry has deployed larger, more productive turbines. Wind last year surpassed hydro-electricity to become the fourth biggest generator in the US. We expect current wind capacity to at least double by 2030.

Many of these new energy technologies are, of course, variable (no wind, no wind power; no sun, no solar power). Thus the growth in these and other new energy technologies will be accompanied by unprecedented sales of new batteries of various shapes and sizes.

Utilities such as Southern California Edison and others have already begun piloting large-scale batteries in certain markets while providers such Stem and Tesla offer “behind-the-meter” storage solutions for businesses and homeowners.

In the past five years, lithium-battery prices have fallen by at least 57% and we expect a further 60% drop by 2025. That will contribute to 9.5GWh/5.7GW of battery capacity in the US by 2024, up from 1.7GWh/0.9GW today.

Continuing battery price declines will also make electric vehicles (EVs) for the first time a viable option for middle-class US consumers without the benefit of subsidies. Last year, EVs represented 0.8% of global vehicle sales. By 2030, we anticipate that growing to one in four vehicles sold.

The most popular place to fuel such cars could be augmented gasoline stations… or the local grocery store, or simply your garage.

The changes we've seen to date are giving US energy consumers unprecedented opportunities to manage, store, distribute, and even generate energy. However, the new, empowered consumer poses inherent challenges to the traditional command-and-control / hub-and-spoke models of conventional power generation and power markets. Already, we have seen examples around the globe where incumbent utilities were caught flat-footed by rapid clean energy build-outs.

In some cases, it has been heavy subsidies for renewables that have catalyzed the change. But more recently, simple low costs are allowing wind and solar to elbow their way onto the grid.

So, where does "infrastructure" fit into this changing energy landscape?

First, conceptually, we must accept that the empowered consumer is here to stay. To some degree, this acceptance is already underway in the private sector where companies that once focused mainly on large-scale power generation are merging with consumer-facing utilities, or buying smaller solar installers and battery solution providers.

Second, policy-makers should seek to promote infrastructure that accommodates a new, more varied, more distributed world of energy generation and consumption. Most immediately, this can mean supporting greater deployment of so-called smart meters. To date, the US has installed almost 71m of these devices, which enable better communication between energy consumers and utilities. Compare that to Italy where all consumers have such meters and are now receiving a second generation with more

advanced functionality, or China which has installed 447m units, across almost its entire urban population.

Policy-makers may also seek to facilitate the development of high-voltage transmission across state lines. It has long been an adage that the Great Plains states represent the “Saudi Arabia of wind”, given the exceptional resources there. To some degree, those states might as well be in Saudi Arabia, given the major challenges of building transmission that would move electrons generated there to more densely populated states in the east or west. The US has added approximately 1.5GW of high-voltage direct current transmission since 2010. By comparison, China has added 80GW over that time.

Investment is needed at lower voltages too. Our passive, one-directional, electricity distribution system is under strain as new distributed generation capacity comes online.

In addition, policy-makers might also consider ways to expand support for EV charging stations. As sales of such cars grow, consumers are already putting greater pressure on certain distribution nodes around the country. Ensuring that EV “fuel” demand is managed in an orderly manner will be important.

Finally, the changes afoot and to come will require what might best be described as infrastructure “software”. Most importantly and pressingly, this must include the reform of electricity markets to take into account the new realities of 21st century power supply and demand.

It may also include expanded programs to educate energy professionals on the new realities of modern energy markets. And, yes, it could include more software to

improve energy monitoring and optimize system performance.

In closing, I would reiterate that none of this need be done at the exclusion of investing in traditional energy infrastructure where the needs are also pressing. However, any rational discussion about energy infrastructure investment today must do more than take into account the current situation. It must also consider where we will be tomorrow.

Thank you.

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