1. Can someone explain the very high electricity prices that were mentioned in the news? Answered by Michael Wara: Consumers have choices based upon their choice of residential electricity provider and rate plan. They don't have any control over who gets power in a load shedding context (when the power company needs to stop supplying electricity to some customers to keep the system from failing).

Follow on question: Under the price mechanism are consumers not able to specify a maximum price they are willing to pay? And if there is a shortage to the extent that price hits $9000/MWh, who gets the power (and the high bill), and who does not?

In general, the answers to both of your questions are no. The plans you read about (the ones with the $10,000+ bills) don't allow a customer to set a maximum willingness to pay or allow for the choice of declining service during times of very high prices.

2. California has been doing a big push of electrification and many homes do not have other means for heat. What should we learn about grid redundancy not to put people's lives at risk?

The blackouts in Texas do raise important questions about all electric homes. But they also raise them for most modern gas heated homes. Modern gas furnaces cannot run without electricity. Same goes for gas ovens and many gas hot water heaters. So, the big question is how to create a context where customers are resilient during these kinds of weather emergencies. And there are no easy answers.

3. As one panelist mentioned, and as we've read in the newspapers, the Texas grid was very close to total collapse. What would have happened had a total collapse of the grid occurred? Would it have been a much longer process in getting the grid working again--like a matter of weeks or a month?

The Texas grid came close to a total collapse. That would have occurred had frequency on the grid fallen much below 59.3 Hertz (60 is normal). In a few minutes at that level, power plants (including especially several nuclear power plants) would have disconnected in order to protect their systems. This would have caused further declines in frequency, and do further fragmentation of the system. Recovering from that event is called a "black start" and although grid operators plan for it, it's not something that anyone does with any frequency. Experts differ on how long it would actually take but there's no doubt that a Texas wide blackout of even longer duration would have occurred - perhaps extending beyond one week.

4. Do you think conventional urban water systems are sustainable method under climate change problem for resilience urbanization and, energy and water security? Which new method should be used?

Urban water systems need to adapt and diversify in order be resilient to changes in the natural and built environment and the evolving needs of water systems. We know now that the conventional approach of building more and more infrastructure to meet growing demand under potentially dwindling supply is often not sustainable. Instead, focusing on improving efficiency, using natural solutions like green infrastructure, and making more targeted infrastructure investments as needed can water systems more robust for an uncertain future.

5. Is there any value to compare and contrast the country's poor preparation and response to an epidemic with this energy failure. Is our culture a problem?

Yes. In the US, we seem to be allergic to investing in prevention, even though study after study shows that every dollar invested in prevention saves several (often 6 to 10) in response and recovery. This skepticism about investing in prevention appears in deferred maintenance of infrastructure, underinvestment in redundant systems, limited attention to public health, and even poor funding for disaster response (of course, you need more of the latter when you don't invest in the former). My personal impression if that, culturally, the US tends to take the position that risk reduction costs too much and that luck and pluck can get us through tough times. But the data show the opposite. Risk reduction saves money and lives.

6. I have seen the map of communities that believe in climate change
https://climatecommunication.yale.edu/visualizations-data/ycom-us/
Texas communities seem to be behind the curve set by the coastal polities. This has been a fabulous discussion but how do we use/who is using this event to make change, to build resilience.

Great question. It is not clear that a community needs to believe in climate change in order to invest in risk reduction. Even if you think the deep freeze was entirely natural, it is still important to take steps to prevent it from occurring again. Whether or not you believe in climate change could, of course, affect the odds you place on the event happening again. But it is also important to remember that a more resilient electrical grid can improve reliability in response to a wide range of natural and human-caused shocks, from severe storms to major industrial accidents.

7. Agreed that lack of resiliency causes the failure of supply chains for electricity. Is it possibly more important to worry about the impact of climate change on supply chains of food and water. We have to democratize these supply chains.

Agreed. Of course, the deep freeze impacted the supply of both electricity and water. In terms of overall costs, it is likely that the damage to the water infrastructure and from the water

damage will be at least as expensive as the damage from the loss of electricity. But the underlying message about the importance of investing in resilience applies to many sectors, including food, shelter, transportation, and communications. The challenges and the solutions are not the same for every sector, but the importance of resilience is consistent.

.