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00:00:00.690 --> 00:00:03.860 - So I'm gonna talk about COVID-19, Science,

00:00:03.860 --> 00:00:06.130 and the way forward on climate change,

00:00:06.130 --> 00:00:09.060 and this talk will be more conceptual

00:00:09.060 --> 00:00:12.240 and not so much presenting my research.

00:00:12.240 --> 00:00:13.583 So next slide, please.

00:00:15.970 --> 00:00:17.890 So firstly,

00:00:17.890 --> 00:00:20.450 there's really no evidence that climate change

00:00:20.450 --> 00:00:23.440 caused the COVID-19 pandemic.

00:00:23.440 --> 00:00:26.530 However we should note that climate change does cause

00:00:26.530 --> 00:00:29.200 increased spread of infectious diseases

00:00:29.200 --> 00:00:32.010 and could contribute to future pandemics.

00:00:32.010 --> 00:00:35.220 So simply put, mosquitoes, ticks,

00:00:35.220 --> 00:00:38.683 and other disease vectors do better in a warming world.

00:00:39.540 --> 00:00:42.530 Floods, which are more frequent under climate change,

00:00:42.530 --> 00:00:46.790 spread waterborne diseases, or infections, I should say.

00:00:46.790 --> 00:00:50.400 And with regard to future pandemics,

00:00:50.400 --> 00:00:52.940 climate change causes migration

00:00:52.940 --> 00:00:56.120 of both human and animal populations

00:00:56.120 --> 00:00:59.480 and this facilitates mixing of these populations

00:00:59.480 --> 00:01:01.830 which could contribute to viruses

00:01:01.830 --> 00:01:04.760 spilling over from animals to humans.

00:01:04.760 --> 00:01:05.853 Next slide, please.

00:01:07.680 --> 00:01:08.563 However,

00:01:09.670 --> 00:01:11.880 whoops, could you go back one?

00:01:11.880 --> 00:01:13.320 Thanks.

00:01:13.320 --> 00:01:16.420 However climate change and enhanced disasters

00:01:16.420 --> 00:01:19.640 will exacerbate the COVID-19 pandemic.

00:01:19.640 --> 00:01:21.840 I think that's almost guaranteed.

00:01:21.840 --> 00:01:24.780 So we could see floods in the Midwest.

00:01:24.780 --> 00:01:26.860 We almost certainly will see wildfires

00:01:26.860 --> 00:01:29.770 in California later in the season.

00:01:29.770 --> 00:01:32.950 Almost certainly we'll see hurricanes in the Caribbean

00:01:32.950 --> 00:01:36.180 along the Gulf Coast or along the Eastern U.S.,

00:01:36.180 --> 00:01:40.570 and those will produce climate refugees

00:01:40.570 --> 00:01:43.850 who will likely be housed in shelters.

00:01:43.850 --> 00:01:46.800 And of course, during a pandemic,

00:01:46.800 --> 00:01:48.730 we don't want people housed in shelters,

00:01:48.730 --> 00:01:50.890 that it's closed quarters

00:01:51.750 --> 00:01:53.083 and not a good idea.

00:01:54.930 --> 00:01:56.140 There could be destruction

00:01:56.140 --> 00:01:58.450 of healthcare system infrastructure

00:01:58.450 --> 00:02:00.913 by hurricanes, wildfires, et cetera,

00:02:02.080 --> 00:02:03.970 and we could see more overwhelming

00:02:03.970 --> 00:02:06.040 of the healthcare systems,

00:02:06.040 --> 00:02:08.090 the various healthcare systems

00:02:08.090 --> 00:02:10.420 with both disaster-related patients,

00:02:10.420 --> 00:02:13.283 in addition to COVID-19 patients.

00:02:14.500 --> 00:02:18.140 Another example of how climate change

00:02:18.140 --> 00:02:21.500 and COVID-19 pandemic could interact

00:02:21.500 --> 00:02:25.580 is the Locust plague, which you've probably heard about,

00:02:25.580 --> 00:02:27.350 that's going on in East Africa.

00:02:27.350 --> 00:02:30.120 It's been happening for the last several months.

00:02:30.120 --> 00:02:33.650 It's thought that very heavy rains in East Africa

00:02:33.650 --> 00:02:35.623 precipitated this locust plague,

00:02:36.480 --> 00:02:38.293 probably related to climate change.

00:02:41.050 --> 00:02:44.810 The Locust plague has been causing agricultural failures,

00:02:44.810 --> 00:02:46.530 leading to food insecurity,

00:02:46.530 --> 00:02:48.850 leading to malnourished people

00:02:48.850 --> 00:02:50.880 who have weakened immune systems

00:02:50.880 --> 00:02:53.863 who will be more susceptible to the virus.

00:02:54.850 --> 00:02:55.923 Next slide, please.

00:02:57.320 --> 00:02:58.690 So there are many parallels

00:02:58.690 --> 00:03:00.760 between the pandemic and climate change.

00:03:00.760 --> 00:03:02.930 So let me state some of those.

00:03:02.930 --> 00:03:05.080 So first, of course,

00:03:05.080 --> 00:03:06.930 there have been long-standing warnings

00:03:06.930 --> 00:03:09.710 by scientists that have not been heeded

00:03:09.710 --> 00:03:14.710 about the risk of pandemics and about climate change.

00:03:14.890 --> 00:03:17.260 And since they've not been heeded,

00:03:17.260 --> 00:03:19.040 prevention and preparedness efforts

00:03:19.040 --> 00:03:20.743 have been woefully inadequate.

00:03:22.440 --> 00:03:23.273 Secondly,

00:03:24.713 --> 00:03:28.000 for both the pandemic and climate change,

00:03:28.000 --> 00:03:30.760 they're both disasters for public health

00:03:30.760 --> 00:03:33.510 and for the economy, and we'll get back to the economy.

00:03:34.950 --> 00:03:37.220 Both prey on the most vulnerable,

00:03:37.220 --> 00:03:40.523 including the elderly, poor and people of color.

00:03:43.430 --> 00:03:48.360 For both, an effective response requires early action,

00:03:48.360 --> 00:03:52.730 federal government leadership, international cooperation,

00:03:52.730 --> 00:03:56.070 and unprecedented societal mobilization.

00:03:56.070 --> 00:03:59.560 So for climate change,

00:03:59.560 --> 00:04:01.500 these four

00:04:01.500 --> 00:04:03.030 responses

00:04:03.030 --> 00:04:03.990 have been

00:04:05.320 --> 00:04:07.160 extremely poor.

00:04:07.160 --> 00:04:08.280 I'd say actually

00:04:09.980 --> 00:04:12.350 somewhat better for the pandemic.

00:04:12.350 --> 00:04:14.030 We could have a discussion about that,

00:04:14.030 --> 00:04:18.450 but also a lot of failings for the pandemic as well.

00:04:18.450 --> 00:04:19.533 Next slide, please.

00:04:21.730 --> 00:04:26.430 So both crises are urgent, but on different timescales.

00:04:26.430 --> 00:04:28.050 For the pandemic,

00:04:28.050 --> 00:04:30.010 it will probably play out over a period

00:04:30.010 --> 00:04:31.743 of months to several years.

00:04:33.800 --> 00:04:35.870 We could say it's the worst acute

00:04:35.870 --> 00:04:38.650 public health crisis in a century.

00:04:38.650 --> 00:04:40.500 I would argue that it's probably

00:04:40.500 --> 00:04:42.540 not the worst, at least not yet,

00:04:42.540 --> 00:04:45.480 not the worst public health crisis in a century.

00:04:45.480 --> 00:04:48.333 We have to compare it with the tobacco epidemic,

00:04:49.466 --> 00:04:50.883 obesity, HIV.

00:04:54.535 --> 00:04:57.440 So it remains to be seen where this

00:04:57.440 --> 00:04:59.240 pandemic will be situated overall,

00:04:59.240 --> 00:05:02.270 but certainly as an acute public health crisis,

00:05:02.270 --> 00:05:03.263 it's the worst.

00:05:05.260 --> 00:05:07.380 With regard to climate change,

00:05:07.380 --> 00:05:10.660 the timescale is decades to centuries,

00:05:10.660 --> 00:05:12.040 and it's possibly the worst

00:05:12.040 --> 00:05:14.700 public health crisis in human history,

00:05:14.700 --> 00:05:18.390 depending on what we do over the next decade or two.

00:05:18.390 --> 00:05:19.493 Next slide, please.

00:05:21.650 --> 00:05:24.783 So both crises can be solved by science.

00:05:25.620 --> 00:05:29.170 For the pandemic, we've been talking a lot, of course,

00:05:29.170 --> 00:05:32.050 about physical distancing, testing,

00:05:32.050 --> 00:05:34.743 contact tracing, quarantining, PPE,

00:05:36.300 --> 00:05:37.860 ventilators,

00:05:37.860 --> 00:05:41.000 the need to develop through scientific research

00:05:41.000 --> 00:05:44.733 antiviral medications, as well as a vaccine.

00:05:46.690 --> 00:05:48.090 So I think it's pretty clear

00:05:49.478 --> 00:05:52.670 how science needs to be used to solve the pandemic.

00:05:52.670 --> 00:05:54.780 With regard to climate change,

00:05:54.780 --> 00:05:57.560 scientists have shown that it's real,

00:05:57.560 --> 00:05:59.950 that it's caused by humans,

00:05:59.950 --> 00:06:02.400 that it's harming public health,

00:06:02.400 --> 00:06:05.273 and that the longer we delay, the worse it will get.

00:06:06.310 --> 00:06:09.730 And through science, we actually know what the solution is,

00:06:09.730 --> 00:06:11.300 which essentially is to convert

00:06:11.300 --> 00:06:13.610 from a fossil-fuel-based economy

00:06:13.610 --> 00:06:16.083 to a renewable-energy-based economy.

00:06:17.150 --> 00:06:21.140 That's a tall order, but as we'll talk about, it's doable.

00:06:21.140 --> 00:06:22.243 Next slide, please.

00:06:24.820 --> 00:06:29.820 So, the world economy has taken a big hit, as you all know.

00:06:30.000 --> 00:06:31.940 It's gonna need to be rebuilt

00:06:32.810 --> 00:06:34.530 and I would suggest that there are

00:06:34.530 --> 00:06:37.500 two paths for rebuilding the world economy.

00:06:37.500 --> 00:06:39.660 There's the path backwards,

00:06:39.660 --> 00:06:43.410 in which we would double down on our fossil fuel economy,

00:06:43.410 --> 00:06:45.030 or the path forward,

00:06:45.030 --> 00:06:48.850 in which we would seize this unprecedented opportunity

00:06:48.850 --> 00:06:51.920 to build a renewable energy economy.

00:06:51.920 --> 00:06:52.753 Next slide.

00:06:55.354 --> 00:06:57.710 So first, the path backwards.

00:06:57.710 --> 00:07:01.133 This path would pit the environment against the economy.

00:07:02.360 --> 00:07:05.800 It's a tried-and-true tactic that's been used

00:07:07.630 --> 00:07:10.740 and we continue to rollback environmental regulations

00:07:10.740 --> 00:07:12.393 and suspend enforcement.

00:07:15.190 --> 00:07:17.610 There will be stimulus infrastructure

00:07:17.610 --> 00:07:20.210 and/or infrastructure packages,

00:07:20.210 --> 00:07:22.130 no matter what the path,

00:07:22.130 --> 00:07:24.080 and the path backwards,

00:07:24.080 --> 00:07:27.630 that we'd have a package that first has no

00:07:27.630 --> 00:07:30.880 environmental requirements for bailed-out industries,

00:07:30.880 --> 00:07:34.690 like airlines, cruise ships and industrial agriculture,

00:07:34.690 --> 00:07:36.280 and that, second,

00:07:36.280 --> 00:07:40.600 resuscitates and entrenches the fossil fuel industry,

00:07:40.600 --> 00:07:44.320 which as you know, is currently kind of on its heels,

00:07:44.320 --> 00:07:45.153 and

00:07:47.040 --> 00:07:48.550 the path backwards will attempt

00:07:48.550 --> 00:07:50.403 to do that for decades to come.

00:07:51.610 --> 00:07:52.633 Next slide, please.

00:07:54.000 --> 00:07:56.490 So then there's the path forward.

00:07:56.490 --> 00:07:59.140 So first, I would say,

00:07:59.140 --> 00:08:01.540 and this isn't the main part of the path forward,

00:08:01.540 --> 00:08:05.030 but I think it's important to note,

00:08:05.030 --> 00:08:08.260 we would retain what we've learned during the pandemic.

00:08:08.260 --> 00:08:09.490 So that would include

00:08:10.390 --> 00:08:12.670 reducing business travel by relying

00:08:12.670 --> 00:08:15.020 more heavily on video conferencing.

00:08:15.020 --> 00:08:17.540 We've all or a lot of us have really

00:08:17.540 --> 00:08:20.160 taken up video conferencing in a big way

00:08:20.160 --> 00:08:24.653 and we know how to do it and it's actually quite useful.

00:08:27.730 --> 00:08:29.800 And of course, if we reduce business travel,

00:08:29.800 --> 00:08:32.550 that reduces greenhouse gas emissions.

00:08:32.550 --> 00:08:35.120 We could see an increase in remote working,

00:08:35.120 --> 00:08:37.220 which many of us have been doing

00:08:37.220 --> 00:08:39.163 and we've got a taste for that.

00:08:40.260 --> 00:08:41.880 It's not that hard to do,

00:08:41.880 --> 00:08:44.713 and that would also decrease greenhouse gas emissions.

00:08:45.640 --> 00:08:48.260 We could produce more of our own goods,

00:08:48.260 --> 00:08:50.750 such as drugs, medical equipment,

00:08:50.750 --> 00:08:53.550 and personal protective equipment

00:08:53.550 --> 00:08:55.230 in order to reduce vulnerability

00:08:55.230 --> 00:08:57.103 to globalized supply networks.

00:08:57.959 --> 00:09:00.190 So that would reduce shipping

00:09:00.190 --> 00:09:02.840 and also greenhouse gas emissions

00:09:02.840 --> 00:09:05.550 and we can convert

00:09:05.550 --> 00:09:08.660 healthcare systems from single-use to reusable PPE

00:09:09.910 --> 00:09:11.473 masks, gowns, gloves.

00:09:12.550 --> 00:09:15.290 Single-use is tremendously wasteful

00:09:15.290 --> 00:09:18.660 and has a larger greenhouse gas footprint

00:09:18.660 --> 00:09:20.563 than doing reusable.

00:09:21.440 --> 00:09:22.513 Next slide, please.

00:09:24.840 --> 00:09:27.420 So the main element of the path forward

00:09:27.420 --> 00:09:30.870 is to heavily invest in renewable energy.

00:09:30.870 --> 00:09:34.160 So the foundation of a transition

00:09:34.160 --> 00:09:36.770 to a renewable energy economy

00:09:36.770 --> 00:09:39.653 is to generate electricity with renewable energy.

00:09:40.530 --> 00:09:45.110 So once that's done, we can electrify transportation,

00:09:45.110 --> 00:09:47.343 heating of buildings, and industry.

00:09:49.030 --> 00:09:52.160 All of that's gonna require a huge amount of electricity.

00:09:52.160 --> 00:09:53.670 So it's important to develop

00:09:53.670 --> 00:09:56.210 energy efficiency and conservation,

00:09:56.210 --> 00:09:58.120 which could include

00:09:58.120 --> 00:10:00.600 dense well-designed livable cities

00:10:01.859 --> 00:10:03.743 that are a lot more energy efficient,

00:10:05.020 --> 00:10:06.810 developing mass transportation,

00:10:06.810 --> 00:10:08.790 which is also much more energy efficient

00:10:08.790 --> 00:10:09.623 than

00:10:11.620 --> 00:10:13.823 single-occupied automobiles,

00:10:14.930 --> 00:10:15.780 and high-speed

00:10:16.950 --> 00:10:20.393 inter-city trains to replace regional air travel.

00:10:22.370 --> 00:10:26.510 Parenthetically air travel is one of the complicated issues

00:10:26.510 --> 00:10:30.870 with regard to accomplishing zero greenhouse gas emissions

00:10:30.870 --> 00:10:35.870 because we don't know yet how we're gonna fly airplanes

00:10:36.030 --> 00:10:37.833 without burning fossil fuels.

00:10:39.660 --> 00:10:42.290 Then the final element that I'll mention

00:10:42.290 --> 00:10:43.470 that's related to all this

00:10:43.470 --> 00:10:46.063 is carbon dioxide capture and storage.

00:10:47.810 --> 00:10:50.960 Unfortunately the world has dithered so long

00:10:50.960 --> 00:10:54.040 with regard to reducing greenhouse gas emissions

00:10:54.040 --> 00:10:57.670 that in addition to reducing emissions,

00:10:57.670 --> 00:10:59.400 we're gonna have to also

00:11:00.440 --> 00:11:02.600 capture and store CO2.

00:11:02.600 --> 00:11:04.910 Now that could be done through natural mechanisms

00:11:04.910 --> 00:11:09.143 by reforestation, and also agricultural soil management,

00:11:10.490 --> 00:11:13.160 which, unfortunately, that might not be enough.

00:11:13.160 --> 00:11:17.220 And so people are trying to develop technologies

00:11:17.220 --> 00:11:19.380 to remove CO2 from the atmosphere,

00:11:19.380 --> 00:11:21.160 and then store it underground.

00:11:21.160 --> 00:11:24.350 Those technologies are not there yet,

00:11:24.350 --> 00:11:29.350 but we could invest in research on those technologies.

00:11:29.930 --> 00:11:30.973 Next slide, please.

00:11:34.000 --> 00:11:36.990 Then the final part of the path forward that I see

00:11:36.990 --> 00:11:40.660 is to invest in science education and literacy.

00:11:40.660 --> 00:11:43.460 So the COVID-19 experience I think shows

00:11:43.460 --> 00:11:45.500 that people respond to clear

00:11:45.500 --> 00:11:48.810 science-based messages from trusted sources.

00:11:48.810 --> 00:11:49.643 So

00:11:50.830 --> 00:11:52.510 it hasn't been perfect, obviously,

00:11:52.510 --> 00:11:56.750 and we haven't seen those science-based messages

00:11:56.750 --> 00:11:58.500 from some of our leadership,

00:11:58.500 --> 00:12:00.830 but we have seen it from other leadership,

00:12:00.830 --> 00:12:02.253 a lot of the governors,

00:12:03.130 --> 00:12:08.130 from medical leadership, such as Doctor Fauci and others,

00:12:08.420 --> 00:12:11.550 and it's actually been to me quite remarkable

00:12:14.400 --> 00:12:16.660 how much adherence there has been

00:12:16.660 --> 00:12:18.643 to the physical distancing.

00:12:19.840 --> 00:12:24.140 Now we might see some degradation and change in that.

00:12:24.140 --> 00:12:26.870 There's gonna be political demagoguery

00:12:26.870 --> 00:12:30.020 and there's a lot of misinformation on the internet,

00:12:30.020 --> 00:12:31.410 but nevertheless I think

00:12:32.520 --> 00:12:34.480 we could point to a positive experience

00:12:34.480 --> 00:12:37.803 with regards to science communication for COVID-19.

00:12:38.640 --> 00:12:41.257 So we need to do the same thing with climate change

00:12:41.257 --> 00:12:44.980 and we need to educate the general public, policy makers,

00:12:44.980 --> 00:12:47.360 medical and public health professionals,

00:12:47.360 --> 00:12:50.410 and really students at all levels about climate change,

00:12:50.410 --> 00:12:52.420 about its public health impacts

00:12:52.420 --> 00:12:55.050 and the feasibility of both solutions.

00:12:55.050 --> 00:12:56.103 Next slide, please.

00:12:58.092 --> 00:12:58.950 So this is

00:12:59.890 --> 00:13:00.870 a little complicated,

00:13:00.870 --> 00:13:03.290 but I think it's an important slide.

00:13:03.290 --> 00:13:04.690 So I'll walk you through it.

00:13:05.850 --> 00:13:08.850 This is looking at generation of electricity

00:13:08.850 --> 00:13:12.300 by different types of renewable energy

00:13:12.300 --> 00:13:17.300 and it's comparing the cost in dollars per kilowatt hour

00:13:17.690 --> 00:13:19.410 on the y-axis

00:13:19.410 --> 00:13:21.643 between 2010

00:13:21.643 --> 00:13:22.476 and 2018.

00:13:23.930 --> 00:13:28.690 It's important to note the kind of light tan coloring,

00:13:28.690 --> 00:13:31.913 and that's the fossil fuel cost range.

00:13:34.340 --> 00:13:37.570 Now, just to go through this quickly, then,

00:13:37.570 --> 00:13:42.320 you could see that for bioenergy, geothermal, and hydro,

00:13:42.320 --> 00:13:44.330 that those are all at the lower end

00:13:44.330 --> 00:13:46.750 of the fossil fuel cost range.

00:13:46.750 --> 00:13:49.380 Then very notably for solar

00:13:50.240 --> 00:13:51.400 voltaics,

00:13:51.400 --> 00:13:52.750 between 2010

00:13:52.750 --> 00:13:57.020 and 2018, we saw a dramatic drop in costs.

00:13:57.020 --> 00:13:59.210 We're now, in 2018,

00:13:59.210 --> 00:14:03.160 the cost is in the low range of the fossil fuel cost range.

00:14:03.160 --> 00:14:04.740 Concentrated solar power,

00:14:04.740 --> 00:14:08.320 which is another type of solar power,

00:14:08.320 --> 00:14:10.330 that I won't go into the details,

00:14:10.330 --> 00:14:12.560 there's been a very dramatic drop as well,

00:14:12.560 --> 00:14:14.980 although it's actually still a bit

00:14:14.980 --> 00:14:17.510 above the fossil fuel cost range.

00:14:17.510 --> 00:14:19.390 And then for offshore wind,

00:14:19.390 --> 00:14:22.970 has gone down to the mid range for fossil fuels

00:14:22.970 --> 00:14:24.810 and onshore wind is

00:14:24.810 --> 00:14:29.120 at the lower end now in terms of the range of fossil fuels.

00:14:29.120 --> 00:14:31.610 So the point I'd like to make here is

00:14:31.610 --> 00:14:35.260 that fossil fuel advocates

00:14:35.260 --> 00:14:37.800 say renewable energy would be nice,

00:14:37.800 --> 00:14:41.450 but it's really not feasible, it's not cost effective,

00:14:41.450 --> 00:14:44.350 but the fact is that that's not true,

00:14:44.350 --> 00:14:47.410 that we've reached a point technologically

00:14:47.410 --> 00:14:49.740 that it is feasible to make this transition

00:14:49.740 --> 00:14:52.200 from fossil fuels to renewable energy.

00:14:52.200 --> 00:14:54.650 There are still a few technological

00:14:55.780 --> 00:14:57.350 improvements that need to be made,

00:14:57.350 --> 00:15:00.373 such as battery storage of energy,

00:15:01.410 --> 00:15:02.900 but it's really there

00:15:04.290 --> 00:15:07.190 and so this is very feasible.

00:15:07.190 --> 00:15:09.710 It just requires political will

00:15:09.710 --> 00:15:12.550 and the necessary investments.

00:15:12.550 --> 00:15:13.783 Final slide, please.

00:15:15.690 --> 00:15:17.950 So I'd like to end

00:15:17.950 --> 00:15:21.717 with this quote that, ”optimism is a moral imperative,”

00:15:22.650 --> 00:15:27.580 and that's because pessimism is a self-fulfilling prophecy.

00:15:27.580 --> 00:15:28.413 So I think

00:15:29.470 --> 00:15:32.960 we have a long road ahead with regard to climate change,

00:15:32.960 --> 00:15:36.000 but it's important to have optimism

00:15:36.000 --> 00:15:38.500 to motivate and sustain our work.

00:15:38.500 --> 00:15:39.403 So, thank you.