It's easy to forget that last night, one billion people went to sleep without access to electricity. One billion people. Two and a half billion people did not have access to clean cooking fuels or clean heating fuels. Those are the problems in the developing world. And it's easy for us not to be empathetic with those people who seem so distanced from us.

But even in our own world, the developed world, we see the tension of stagnant economies impacting the lives of people around us. We see it in whole pieces of the economy, where the people involved have lost hope about the future and despair about the present. We see that in the Brexit vote. We see that in the Sanders/Trump campaigns in my own country. But even in countries recently turning the corner towards being in the developed world, in China, we see the difficulty that President Xi has as he begins to un-employ so many people in his coal and mining industries who see no future for themselves. As we as a society figure out how to manage the problems of the developed world and the problems of the developing world, we have to look at how we move forward and manage the environmental impact of those decisions.

We've been working on this problem for 25 years, since Rio, the Kyoto Protocols. Our most recent move is the Paris Treaty and the resulting climate agreements that are being ratified by nations around the world. I think we can be very hopeful that those agreements, which are bottom-up agreements where nations have said what they think they can do, are genuine and forthcoming for most parties. The unfortunate thing is that now, as we look at the independent analyses of what those climate treaties are liable to yield, the magnitude of the problem before us becomes apparent.

This is the United States Energy Information Agency's assessment of what will happen if the countries implement the climate commitments that they've made in Paris between now and 2040. It shows basically CO2 emissions around the world over the next 30 years. There are three things that you need to look at and appreciate.

One, CO2 emissions are expected to continue to grow for the next 30 years. In order to control climate, CO2 emissions have to literally go to zero because it's the cumulative emissions that drive heating on the planet. This should tell you that we are losing the race to fossil fuels.

The second thing you should notice is that the bulk of the growth comes from developing countries, from China, India, from the rest of the world, which includes South Africa and Indonesia and Brazil, as most of these countries move their people into the lower range of lifestyles that we literally take for granted in the developed world.

The final thing that you should notice is that each year, about ten gigatons of carbon are getting added to the planet's atmosphere and then diffusing into the ocean and into the land. That's on top of the 550 gigatons that are in place today. At the end of 30 years, we will have put 850 gigatons of carbon into the air, and that probably goes a long way towards locking in a 2-4 degree C increase in global mean surface temperatures, locking in ocean acidification and locking in sea level rise.

Now, this is a projection made by men by the actions of society, and it's ours to change, not to accept. But the magnitude of the problem is something we need to appreciate.

Different nations make different energy choices. It's a function of their natural resources. It's a function of their climate. It's a function of the development path that they've followed as a society. It's a function of where on the surface of the planet they are. Are they where it's dark a lot of the time, or are they at the mid-latitudes? Many, many, many things go into the choices of countries, and they each make a different choice.

The overwhelming thing that we need to appreciate is the choice that China has made. China has made a choice and will make a choice, to run on coal. The United States has an alternative. It can run on natural gas as a result of the inventions of fracking and shale gas, which we have here. They provide an alternative. The OECD Europe has a choice. It has renewables that it can afford to deploy in Germany because it's rich enough to afford to do it. The French and the British showed interest in nuclear power. Eastern Europe is still very heavily committed to natural gas and to coal, and with natural gas that comes from Russia, with all of its entanglements. China has many fewer choices and a much harder row to hoe.

If you look at China and you ask yourself why coal has been important to it, you have to remember what China's done. China brought people to power, not power to people. It didn't do rural electrification. It urbanised. It is urbanised by taking low-cost labour and low-cost energy, creating export industries that could fund a tremendous amount of growth.

If we look at China's path, all of us know that prosperity in China has dramatically increased. In 1980, 80 per cent of China's population lived below the extreme poverty level, below the level of $1.90 per person per day. By the year 2000, only 20 per cent of China's population lived below the extreme poverty level -- a remarkable feat, admittedly, with some costs in civil liberties that would be tough to accept in the Western world. But the impact of all that wealth allowed people to get massively better nutrition. It allowed water pipes to be placed. It allowed sewage pipes to be placed, causing a dramatic decrease in diarrheal diseases at the cost of some outdoor air pollution.

But in 1980, and even today, the number one killer in China is indoor air pollution because people do not have access to clean cooking and heating fuels. In fact, in 2040, it's still estimated that 200 million people in China will not have access to clean cooking fuels. They have a remarkable path to follow.

India also needs to meet the needs of its own people, and it's going to do that by burning coal. When we look at the EIA's projections of coal burning in India, India will supply nearly four times as much of its energy from coal as it will from renewables. It's not because they don't know the alternatives; it's because rich countries can do what they choose, and poor countries do what they must.

So, what can we do to stop coal's emissions in time? What can we do to change this forecast in front of us? Because it's a forecast that we can change if we have the will to do it.

First of all, we have to think about the magnitude of the problem. Between now and 2040, 800 to 1,600 new coal plants are going to be built around the world. This week, between one and three one-gigawatt coal plants, are being turned on around the world. What's happening regardless of what we want because the people that rule their countries, assessing the interests of their citizens, have decided it's in the interest of their citizens to do that. And that's going to happen unless they have a better alternative. And every 100 of those plants will use up between one per cent and three per cent of the Earth's climate budget.

So every day that you go home thinking that you should do something about global warming, at the end of that week, remember: somebody fired up a coal plant that's going to run for 50 years and take away your ability to change it.

What we've forgotten is something that Vinod Khosla used to talk about, a man of Indian ethnicity but an American venture capitalist. And he said, back in the early 2000s, that if you needed to get China and India off of fossil fuels, you had to create a technology that passed the "Chindia test," "Chindia" being the appending of the two words. It had to be, first of all, viable, meaning that technically, they could implement it in their country and that it would be accepted by the people in the country.

Two, it had to be a scalable technology, that it could deliver the same benefits on the same timetable as fossil fuels, so that they can enjoy the kind of life, again, that we take for granted.

And third, it had to be cost-effective without subsidy or a mandate. It had to stand on its own two feet; it could not be maintained for that many people if those countries had to go begging or had some foreign country say, "I won't trade with you," to get the technology shift to occur.

If you look at the Chindia test, we simply have not come up with alternatives that meet that test. That's what the EIA forecast tells us. China's building 800 gigawatts of coal, 400 gigawatts of hydro, about 200 gigawatts of nuclear, and on an energy-equivalent basis, adjusting for intermittency, about 100 gigawatts of renewables. 800 gigawatts of coal. They're doing that, knowing the costs better than any other country, knowing the need better than any other country. But that's what they aim for in 2040 unless we give them a better choice. It will have to meet the Chindia test to give them a better choice.

If you look at all the alternatives that are out there, there are really two that come near to meeting it. First is this area of new nuclear that I'll talk about in just a second. It's a new generation of nuclear plants that are on the drawing boards around the world, and the people who are developing these say we can get them in position to demo by 2025 and to scale by 2030 if you will just let us. The second alternative that could be there in time is utility-scale solar backed up with natural gas, which we can use today, versus the batteries, which are still under development.

So what's holding new nuclear back? Outdated regulations and yesterday's mindsets. We have not used our latest scientific thinking on radiological health to think about how we communicate with the public and govern the testing of new nuclear reactors. We have new scientific knowledge that we need to use in order to improve the way we regulate the nuclear industry.

The second thing is we've got a mindset that it takes 25 years and 2 to 5 billion dollars to develop a nuclear power plant. That comes from the historical, military mindset of the places nuclear power came from. These new nuclear ventures are saying that they can deliver power for 5 cents a kilowatt hour; they can deliver it for 100 gigawatts a year; they can demo it by 2025, and they can deliver it in scale by 2030 if only we give them a chance.

Right now, we're basically waiting for a miracle. What we need is a choice. If they can't make it safe, if they can't make it cheap, it should not be deployed. But what I want you to do is not carry an idea forward, but write your leaders, write the head of the NGOs you support, and tell them to give you a choice, not the past.

Thank you very much.

(Applause)

很容易忘记，昨晚有十亿人没有电力供应。十亿人。有二十五亿人没有接触到洁净烹饪燃料或供暖燃料。这些是发展中国家面临的问题。对于那些与我们看似相隔甚远的人，我们很容易失去同情心。

但是即使在我们自己的世界，发达世界，我们也看到了停滞的经济对我们周围人生活的影响。我们在整个经济体中看到这一点，其中参与者已对未来失去希望，对现状感到绝望。我们在英国脱欧公投中看到了这一点。我们在我自己国家的桑德斯/特朗普竞选中看到了这一点。但即使在最近步入发达世界的国家，比如中国，我们也看到了习近平主席在开始解雇许多在煤炭和矿业行业中没有未来的人所面临的困难。当我们作为一个社会努力解决发达国家和发展中国家的问题时，我们必须审视如何前进并处理这些决策对环境的影响。

我们已经在解决这个问题上工作了25年，从里约峰会开始，京都议定书。我们最近的举措是《巴黎协定》，并由此产生的气候协议正在全球范围内得到批准。我认为我们可以对这些协议充满希望，因为这些是从下至上的协议，各国表达了自己的承诺，大多数各方都是真诚的。不幸的是，现在，当我们审视独立的分析报告，对这些气候协议可能带来的影响，我们意识到问题的规模。

这是美国能源信息署对各国实现《巴黎协定》所做的评估，涵盖了未来30年全球二氧化碳排放的情况。有三点需要特别注意和认识到。

首先，预计二氧化碳排放在未来30年内将继续增长。为了控制气候，二氧化碳排放必须几乎降至零，因为正是累积排放导致地球变暖。这表明我们正在输掉与化石燃料的竞赛。

其次，增长的主要来源来自发展中国家，比如中国、印度，以及其他国家，如南非、印度尼西亚和巴西，这些国家的人们正朝着我们在发达世界中习以为常的较低生活水平迈进。

最后一点是，每年会有约十吉兆吨的碳被排放到地球的大气中，然后扩散到海洋和陆地中。这是在现有550吉兆吨碳的基础上。在30年结束时，我们将会向大气中排放850吉兆吨碳，这可能会导致全球平均表面温度上升2-4摄氏度，同时导致海洋酸化和海平面上升。

这是一个由社会行为所作出的预测，我们有能力去改变它，而不是接受它。但问题的规模是我们需要认识到的。

不同的国家会做出不同的能源选择。这是他们自然资源的一个决定，也与气候有关，与社会发展路径相关，也与他们所处的地理位置有关。比如他们是位于经常黑暗的地区，还是位于中纬度地区。很多很多事情影响着国家的选择，他们每个国家都有不同的选择。

我们需要特别认识到的是中国所做的选择。中国已经做出了一个选择，也将继续做出一个选择，即依靠煤炭。美国有另外一个选择。由于水力压裂和页岩气的发明，美国可以依靠天然气。这提供了一种替代选择。欧洲经济合作与发展组织（OECD）的欧洲有选择。德国可以负担得起部署可再生能源，因为它富裕到有能力这样做。法国和英国对核能表现出了兴趣。东欧仍然对天然气和煤炭高度依赖，并使用来自俄罗斯的天然气，带来许多复杂问题。中国的选择有限，面临更为艰巨的任务。

如果我们审视中国，问一下为什么煤炭对它很重要，我们必须记住中国的过去。中国使人民上升，而不是给予电力。它没有进行乡村电气化。它是通过利用低成本的劳动力和低成本的能源，打造出能够为巨大增长提供资金的出口产业来实现城市化的。我们知道中国繁荣增长的过程，到1980年，80%的中国人口生活在极端贫困线以下，每人每天不足1.9美元。到2000年，只有20%的中国人口生活在极端贫困线以下。这是一个显著的成就，虽然在获得这些经济繁荣的同时，也可能带来一些在西方世界很难接受的公民自由成本。但这种经济繁荣带来了很多好处，人们获得了更好的营养，有了自来水和下水道系统，从而显著减少了腹泻等疾病，代价是一些室外空气污染。

但是到1980年，甚至到今天，室内空气污染仍然是中国的头号杀手，因为人们无法获取洁净的烹饪和供暖燃料。事实上，预计到2040年，仍然有2亿人在中国没有洁净的烹饪燃料可用。他们面临着一条充满挑战的道路。

印度也需要满足其人民的需求，他们将通过燃烧煤炭来实现这一目标。当我们审视美国能源信息署关于印度燃烧煤炭的预测时，印度从煤炭中获得的能源将几乎是从可再生能源获得的能源的四倍。这并不是因为他们不知道其他选择，而是因为富裕国家可以做出自己的选择，而贫穷国家只能做出必要的选择。

那么，我们能够在时间内阻止煤炭排放吗？我们能够改变面前的这个预测吗？如果我们有决心，我们是可以改变这个预测的。

首先，我们必须考虑问题的规模。从现在到2040年，全球将会建造800到1600个新的煤电厂。本周，全球将启用一到三个吉瓦煤电厂。这是不管我们想要的情况下发生的，因为执政者们根据他们国家的利益作出了决定。这种情况将会继续发生，除非他们有更好的选择。每一百个煤电厂将消耗地球气候预算的1%到3%。

所以，在你每天回家时认为你应该为全球变暖做点什么的时候，你应该记住：某人点燃了一个将运行50年的煤电厂，让你失去了改变它的能力。

我们忘记了文内尔德·科斯拉曾谈论过的一件事，他是印度裔美国风险投资家。他在21世纪初曾说过，如果要让中国和印度摆脱化石燃料，就必须创造出一种通过"Chindia"测试的技术，"Chindia"是中国和印度的组合词。首先，它必须是可行的，从技术上讲，他们可以在他们的国家实施，并且会被该国人民接受。其次，它必须是可扩展的技术，以便在相同的时间表上提供与化石燃料相同的好处，这样他们才能享受到我们所习以为常的生活。

第三，它必须在没有补贴或强制命令的情况下具有成本效益。它必须自给自足，如果这些国家不得不向外国乞求或是某个外国说"我不与你交易"来实现技术转换，那么它是无法满足这么多人的需求的。

如果你看看"Chindia"测试，我们还没有提供符合这个测试的替代选择。这就是美国能源信息署的预测告诉我们的。中国正在建造800吉瓦的煤电厂，400吉瓦的水电厂，约200吉瓦的核电厂，根据能源等价值进行调整，考虑间歇性，还有约100吉瓦的可再生能源。800吉瓦的煤电厂。他们这样做，他们对成本和需求的了解超过任何其他国家。但这是他们在2040年的目标，除非我们给他们更好的选择。这需要符合"Chindia"测试才能给他们更好的选择。

如果我们审视所有可能的替代选择，实际上只有两个接近符合条件。首先是我稍后要谈论的新一代核电。这是世界各地正在规划的新型核电厂，正在开发这些核电厂的人们表示，如果给予机会，到2025年可以进行试验，到2030年可以进行扩展。第二个可能在时间上到达的选择是大规模太阳能发电，使用天然气作为备用，与目前仍在开发的电池相比，我们现在可以使用这种技术。

那么新一代核电为什么被拖慢了？过时的监管规定和昨日的思维模式。我们没有运用我们最新的辐射健康科学来思考如何与公众进行沟通和监管新型核反应堆的测试。我们有新的科学知识需要应用于改进我们的核能行业监管方式。

第二点是，我们认为开发一座核电厂需要25年时间和20-50亿美元。这种观念来自核能来源所在地的历史和军事思维方式。这些新的核能项目表示，他们可以以每千瓦时5美分的价格提供能源，他们可以每年提供100吉瓦的能源，他们可以在2025年展示它，并在2030年进行大规模应用，只要我们给予机会。

现在，我们只是在等待奇迹的出现。我们需要的是一个选择。如果他们不能让它安全，不能让它成本效益，那么它就不应该被部署。但我想让你做的不是只是提出一个想法，而是写信给你的领导，写信给你支持的非政府组织的负责人，告诉他们给你提供一个选择，而不是过去的选择。

非常感谢大家。

（掌声）