

Today's author Google guest is Jeremy Rifkin. The book is titled "Zero Marginal Cost Society: The Internet of Things, the Collaborative Commons and the Eclipse of Capitalism."

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Jeremy is the best-selling author of 19 books on the impact of scientific and technological changes. His books have been translated into more than 35 languages, and are used in hundreds of universities, corporations, and government agencies around the world.

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In 2001, Jeremy Rifkin published the New York Times bestseller, "The Third Industrial Revolution." Presented in this book, his vision of a sustainable post-carbon economic era has been endorsed by the European Union and the United Nations, and embraced by world leaders--including chancellor Angela Merkel of Germany, president Francois Hollande of France, and premiere Li Keqiang of China.

1:00

Rifkin's other recent titles include "The Empathic of Civilization: the Age of Excess," "The End of Work," "The European Dream," "The Biotech Century," and "The Hydrogen Economy."

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Jeremy Rifkin has been an advisor to the European Union for the past decade. He also served as an advisor to President Nicolas Sarkozy of France, chancellor Angela Merkel of Germany, prime minister Jose Socrates of Portugal, prime minister Jose Luis Rodriguez Zapatero of Spain, and prime minister Janez Jansa of Slovenia during their respective European Council presidencies.

1:39

Mr. Rifkin is the principal architect of the European Union's Third Industrial Revolution Long-Term Economic Sustainability plan to address the triple challenge of the global economic crisis, energy security, and climate change. The Third Industrial Revolution was formally endorsed by the European Parliament in 2007, and is now being implemented by various agencies within the European Commission, as well as in the 27 member states.

2:08

Jeremy Rifkin is the president of the TIR Consulting Group, comprised of many of the leading renewable energy companies, electricity transmission companies, construction companies, architectural firms, IT and electronics companies, and transport and logistics companies. Mr. Rifkin is a senior lecturer all the Wharton School executive education program at the University of Pennsylvania. His monthly column on global issues has appeared over many years in many of the world's leading newspapers and magazines, including the Los Angeles Times, The Guardian, Die Deutsch Zeitung, and the Handelsblatts, Le Soir Arnaque, L'Espresso, El Mundo, and El Pais in Spain, and many others. Mr. Rifkin holds a degree in economics from the Wharton School of the University of Pennsylvania, and a degree in international affairs from the Fletcher School of Law and Diplomacy at Tufts University.

JEREMY RIFKIN: Good afternoon, everyone.

3:23

It's a pleasure to be with you here at Google this afternoon. We're just beginning to glimpse the bare outlines of a new economic system entering onto the world stage. This is the first new economic system to emerge since the advent of capitalism--and its antagonist, socialism-- in the early 19th century. It's a remarkable historical event. It has long-term implications for every one of us, our children, and our grandchildren. This new economic system is the collaborative commons. And what's triggering this shift to a new economic paradigm, a collaborative commons economic system, is something called zero marginal cost. Now, zero marginal cost is something you're very familiar with here at Google, and certainly we are the business community-- not very well known in the public. Marginal cost-- the cost of producing an additional unit of a good and service after your fixed costs are covered.

4:39

Business people have always wanted to reduce marginal cost, and they're always in search of doing that. And here's why. And I want to introduce to you a paradox. There's really a paradox deeply embedded in the heart of the capitalist system-- previously undisclosed, really. This paradox has been responsible for the great success of capitalism and the invisible hand of the marketplace. The paradox is this invisible hand success is now leading to its potential demise, and the advent of a new successor paradigm to replace it. Let me explain.

5:18

Sellers in a capitalist market are always attempting to find new technologies that can increase their productivity, reduce their marginal cost so they can put out cheaper products, win over consumers in market share, bring home profits for their investors. Clear? So business people have always welcomed the reduction of marginal cost in the production and distribution of goods and services. It's just that the business community never anticipated in their wildest imagination the prospect of a technology revolution so extreme in its productivity that it could reduce those marginal costs to near zero across the value chain, making goods and services essentially priceless, nearly free, abundant, and beyond the market exchange economy. That's beginning getting to happen.

6:15

The first inkling of this paradox, of course, was Napster, back in 1999. All of a sudden, millions of young people that apparently had nothing else to do after school but figure out new software in order to share music and bypass providing royalties to the music industry. Then this zero marginal cost phenomena went on to invade the entire information goods industry.

6:41

Millions of consumers became prosumers. And they began producing their own information goods-- videos on YouTube, news blogs, e-books, and decimated the newspaper and magazine publishing industry. Newspapers went out of business. Magazines went out of business. And I'm in book publishing. I can tell you that free e-books have decimated the book publishing industry.

7:13

For a long time, industry watchers said, well, this is fine. We understand that more and more people are becoming prosumers. And they're producing and sharing their own audio, their own videos, their own text, their news blogs. They're working together and sharing information on Wikipedia. We understand that. But we think that more and more free goods and services provides the basis so that the premiums will allow people to then go up to this-- the freemiums will allow people to go up and have premiums.

7:43

In other words, if you're a musician, you give away your music. And then you hope that the long tail will set in, and enough people will then decide to go from the freemium to the premium, go to your concert, and pay a lot of money. Or the New York Times will say, look, we'll give out 20 articles a month free. And we hope that the freemium will encourage a certain number of people to subscribe to our new service, the premium. It hasn't happened. This was wishful thinking, or naive.

8:13

The more and more we are able, as prosumers, to produce and share our own information goods, the less likely we are to move from freemiums to premiums. Because our attention span is limited, and there are so much free goods that they really don't push us into the premium category. And the proof is in the pudding. If you take a look at the newspaper industry, magazines, book publishing, and the recording industry, they've never come back from zero marginal cost.

8:43

Economists, however, have-- up until the moment -- now-- our economists have thought, well, we think there's a firewall here. And that is, even though more and more information goods are heading toward near zero marginal cost in virtual worlds, that they will not cross the firewall into the physical world of brick and mortar goods and services. No longer.

9:12

What's happening now is that the communication internet is now expanding to an internet of things, a physical internet. So what we're beginning to see is the communication internet is just beginning in Europe, where I work, to converge with an emerging energy internet that we're laying across Europe, and a nascent automated logistics and transport internet. The internet of things is an expansive internet that allows us to go from the world of bits to the world of atoms. And when we have these three internets embedded in one system-- a communication internet that's interacting continually with an energy internet and a transport and logistics internet in one platform-- this internet of things allows us to begin moving near zero marginal cost from information goods to physical goods.

10:08

The internet of things, three interoperable internets, then connect out with sensors across the entire economic value chain. Even though this internet of things is just in its early stages, we have 14 billion sensors now connecting resource flows. We have sensors connecting warehouses, distribution centers. We have sensors along smart road systems. We have sensors connecting the production lines on the factory floor. We have sensors connecting the new energy internet so we know the price of electricity moment to moment. We have sensors connecting offices and vehicles and homes and appliances, continually feeding big data to these three internets that operate as one platform-- the communication, internet, the fledgling energy internet, the nascent automated transport and logistics internet.

11:02

By 2020, IBM says we'll be at 30 billion sensors. And a recent forecast study a few months ago says that by 2030, we will have 100 trillion sensors connecting everything with everyone in one global neural network. When we move from the internet to the internet of things, and we move from bits to atoms, we began to see a completely new economic model they can get us to near zero marginal cost in the production and distribution of physical energy and physical products.

11:40

So a prosumer, and millions of prosumers-- and pretty soon, billions of prosumers-- are going to be able to go up on this expanded internet which is already here. And they'll be able to access the big data flowing back from all the sensors to the three internets operating in that general purpose technology platform. And with the apps that companies like Google will provide and others, they'll be able to use that data with their own analytics to create their own algorithms, because you can program it right into the app. You don't have to be a rocket scientist. And then any one of millions of prosumers will be able to increase their productivity, dramatically reduce their marginal cost, and produce, consume, and share their own physical energy and manufactured goods with each other, just like we now do with information goods.

12:32

While this is early on, the trajectory is already clear. So if I had said to you in 1989, a year before the World Wide Web went online, that 24 years later 40% of the human race, equipped with a cheap cellphone, a raspberry computer, could send their own audio, video, and text, create their own entertainment, their own news, their own knowledge-- any one of those 40% of the human race-- and then share it with each other at near zero marginal cost on the World Wide Web, what would you have said in 1989? We did it in less than 20 years.

13:13

As we move to the expansive internet of things, and from bits to atoms, what I'm suggesting to you here at Google is we're going to be able, in the next 20 years, to move to near zero marginal cost in the production of energy and some manufactured goods. Let me preface this.

13:32

The big wild card here is food and water and climate change. Because if we can't address climate change and we continue on this road, if we can't produce food and don't have access to water in a

reliable fashion, everything I'm telling you is derailed. Let me give you an example of how this new system is already in place in Europe. Let's take energy.

13:58

We now have millions and millions of players, urban dwellers, small businesses, large companies who are producing their own solar and wind green electricity on site in Europe. And that's at near zero marginal cost right now. So it's not academic. The technology for harvesting solar and wind is still a little pricey, but the price is on an evolutionary curve, just like computer chips. We never expected in 1960 that computer chips would be on an exponential curve. And here's where I agree with Ray Kurzweil who I know is now here with you at Google. Send him my regards.

14:37

We did a lecture together a few years ago. The pricing technology-- a solar watt cost \$60 to produce a solar watt in 1970. It's \$0.66 today, and it's going down. We're in a 20-year exponential curve for solar and wind technologies. So we're going to see the price of these technologies be as cheap as the price that we now have for cellphones, mobile, et cetera in 20 years. We see the curve.

15:04

Ray Kurzweil says that if we are doubling on the exponential curve every two years, eight more doublings, 16 years, we're in the solar age. He may be little optimistic. I'd say within 25 years we're there. But here's the interesting thing.

15:20

The moment you put up a solar panel on your building, or a wind turbine on-site, even before you pay back the fixed cost-- and that's usually three to eight years, so it's not a long time. Immediately though, your marginal costs are near zero, because the sun off your roof is free. The wind off the side of your building is free. The geothermal heat coming up from under the ground is free. Your garbage converted in a bioconverter to energy in your kitchen, that's all free. And in Germany, we've now seen this.

15:49

I've been advising the chancellor, some of you know, and working with the German government for a number of years, many years. We're now at 25% green electricity in Germany in seven years. We're heading to 35% green electricity in four more years. And you know who's producing it all?

16:04

We have a million buildings that have been converted to micro power plants. And millions of small players have joined together in cooperatives-- small and medium-sized businesses, homeowners. They're generating the new electricity.

16:17

What about the big, huge, global electricity companies out of Germany, EnBW, E.ON? They're gone in less than seven years. Remember what happened to the recording industry, what happened to newspapers, what happened to magazines and publishing? This is happening to the huge global power companies in Germany. And they acknowledge it. This last week, one of the directors of E.ON said, we're out of it. They're producing less than 7% of the new power, and going down, down, down. They can't scale it.

16:49

Because in the first and second industrial revolution, we have to scale with vertically-integrated companies that put everything under one roof in order to get economies of scale. The internet of things is designed to be distributed, collaborative, peer-directed. And it scales to lateral economies of scale.

17:07

Think of millions of young people sharing music, wiping out the recording industry. Or think of millions of people sharing knowledge on Wikipedia and wiping out the Encyclopedia Britannica. Now this is actually happening in Germany right now with green electricity. It's a disruptive revolution in the best sense of the term. Then let's take 3D printed products.

17:29

We now have several hundred thousand hobbyists, thousands of small and medium-sized startup companies that are printing out their own 3D printed products. And they're attaching their 3D printing operation, at least in Europe, into this new internet of things, this third Industrial Revolution. So if you were a 3D printer, whether you're in Senegal or Berlin, you go up on the internet. You download your software. It's all free. Most of this software is free, open source. Then you use for your feed stock recycled plastic. They're now using recycled paper, or even using sand and gravel and melting it down. So you can get local feed stock at near zero marginal cost. Then they're powering their 3D printing factory with green energy from their energy internet that's generated at near zero marginal cost. Then they're marketing their products on global websites like Etsy with very little advertising cost. You just pay a short fee, low marginal cost. And then we're just beginning to put in the logistics internet.

18:40

So we have now electric vehicles. And two or three years from now, all the six major auto companies will have fuel cell vehicles out-- trucks, cars, and buses, mass production. You'll be able to power your vehicle to send your 3D printed product to market with your own green electricity from the energy internet, nearly free marginal cost. And the electric vehicles in a few years from now will be printed out. The first printed vehicle now exists Canada, the URBI. You've probably seen it. It runs on solar. It's pretty impressive. And then you'll have GPS guidance. And thanks to Google, we will have driverless vehicles that can move across the system at will near zero marginal cost. This is a revolution.

19:24

19:30

The question becomes this. If millions, then hundreds of millions of people can begin to produce, consume, or share their own information goods, energy, and a lot of their manufactured goods at near zero marginal cost, making them nearly free and beyond the exchange model of the capitalist market, what kind of new economic system do we have to envision here at Google, and other places, to organize the world, the one that I'm laying out here?

20:05

Economists will usually say there's only two ways to organize the economy-- either the government or private enterprise, or some combination of both. Capitalism, socialism, or in Europe, a social market economy. Our economists ignore a third institution, which is responsible in our daily lives for a whole range of goods and services you and I rely on. And it's not market, and it's not government. It's the social commons. Part of it's the formalized not-for-profit sector. But it's the social commons from cooperatives to credit unions. And a huge part of the human race is engaged in activities in the social commons. And with cooperatives, you share.

20:48

And when people say, how do you make money if you're not in a profit-making organization? How do you make profit? Wake up call-- there are hundreds of millions of people, actually billions of people, who are parts of cooperatives.

21:00

The entire world electricity system, the US, are world electric cooperatives. And it's almost 50% of our transmission lines. When you get food at the store, it's coming from agricultural cooperatives. Most people around the world live in housing cooperatives. In Europe, banking cooperatives-- if you're from Europe, they're bigger than the commercial banks. And it goes on, and on, and on.

21:21

So the social commons is ignored by economists because it doesn't create finance capital. It creates social capital. But it's a big revenue player. In 40 countries surveyed, the social commons is responsible for about \$2.2 trillion in revenue, and it's responsible for over 5% of the GDP in many countries, including the US. What's happening now is the social commons-- which is a venerable

institution that we rely on for educational institutions that are nonprofit, health services, day care centers for our children, assisted living for the elderly, environmental organizations, cultural sports, arts, it goes on and on. If they were eliminated and we just had the marketplace, we would not have much of a life on the planet.

22:14

What's making this social commons now more relevant than anytime in the past is this internet of things. Because the internet of things is a general purpose technology platform that's designed to be the technological soul mate of a social commons.

22:31

The whole design is to be distributed, collaborative, scales laterally not vertically, and it rewards collaboration across these lateral networks. It creates a sharing community. And of course, who understands this better than Google? Because you helped us create a sharing community. When we were kids, we always said, boy, it would be nice if there was a magic box. And all we have to do is click in, and all of a sudden, within three seconds, the knowledge of the world. You did it. You did it by cueing into a communication internet that allowed us to laterally scale. But that's just the beginning of the story.

23:09

So what's happening now is this expansive of internet of things allows millions and millions and millions of consumers to be prosumers and join with small and medium-sized enterprises and connect directly, eliminate all the middle men of vertically-integrated global companies.

23:27

It's the middle men in vertically-integrated global corporations, the Fortune 1,000, that mark up their transaction costs along the value chain in order to have the margins. If you eliminate the middle man with laterally-scaled networks, you eliminate all of those margins. And you can directly engage each other. But it creates a new system.

23:52

What I suspect we're seeing here is a hybrid system-- part capitalist market, part collaborative commons. The capitalist market is not going to disappear. There will be many goods that are sophisticated and will require a capitalist exchange economy. And there'll be sufficient margins for profit and return. But I do believe that by the time some of you are my age, mid-century, most of our economic life is going to be on the collaborative commons. It's just too sweet to say no to. There'll be attempts to stop it and thwart it and hold it up. But when the technology's available, people will get it one way or the other.

24:34

The recording industry was not able to stop file sharing of music. The newspaper and magazine industry and book publishing, very powerful industries, they were not able to stop lateral economies of scale. So I think the capitalist market's going to be a very powerful player here, but probably a niche player in a more dominant collaborative commons.

24:56

And it will be an aggregator of networks-- the Googles, the Facebooks, the Twitters. There'll be a lot of this aggregating of networks to provide the technological base for the internet of things expansion, because that's sophisticated software and hardware. That's where you find the edge in order to have the capitalist market work together with a collaborative commons.

25:22

In economics, we've always believed that the most efficient economy is where you sell at marginal cost. We just never expected zero marginal cost. I'll let you in on something. This'll amuse you. And Larry Summers, if you're hear this, my little thing here with the folks at Google, this is pretty interesting. Larry Summers was the president of Harvard University, past US Secretary of the Treasury. In 2001, after the bubble burst, the dot com, the Federal Reserve of Kansas City held a special seminar. They wanted to talk about the new data and information industries that were

emerging. And Larry Summers-- and is it Bradford DeLong here at the University of California?-- issued a paper to start the conversation. They got what was happening. They glimpsed the paradox.
26:11

And so Summers and DeLong said, we have this new technology revolution that's going to be as important as electricity--data, information, and computing. Now the problem we face, though, is marginal cost. Because as this new technology comes on board, we're heading to near zero marginal cost in information goods. But when you get to zero marginal cost, we can't return investment and get profit. So what do we do?
26:42

You know what he suggested? He did say that we agree that the marginal cost is the most efficient place in which to price your product. But he said we can't do this anymore. We're going to have to favor monopolies-- monopolies. Temporary monopolies-- to keep the marginal cost above near zero cost so we can return profits to the investors. You all got this? He said the competitive market-- that's private enterprise capitalism-- does not work when you get to near zero marginal cost. And he said, we don't know what the replacement paradigm will be. The fact that the former Secretary Treasurer and President of Harvard University actually suggested there's a replacement paradigm that the competitive market doesn't function and we need monopoly is astounding. But he thought he was talking to a small group of people inside the Federal Reserve.
27:30

It's in my book in chapter one. Yeah, it's amusing. So I'm waiting to hear from him. I did an opinion piece in The Guardian on this about a week ago. I haven't heard from him yet. He may say silent on this. But what's interesting is he understood the dilemma. He and Bradford DeLong, they understood it. But the dilemma is also an opportunity. And there will be many companies like Google who can find ways to aggregate networks to allow this collaborative commons to flourish and find some value in doing that.
28:07

Nowhere will the impact of near zero marginal cost have a bigger reach than in labor employment. This is what comes up every time I raise this. We're heading to near zero marginal cost labor with these new technologies-- with analytics, algorithms, artificial intelligence, robotics, pattern recognition technology. Some of the older people remember-- well, we talked about it at lunch-- you read my book "The End of Work." Well, I projected in 1995-- you don't look that old, either-- 1995 that we would be moving to a workless world. It was controversial at the time.
28:45

But I notice that now, in the last year, this new spate of books coming out at least acknowledged that that was right on target, that book. We have workerless factories right now. We have virtual retailing right now. We have eliminated massive amounts of blue collar, white collar, and service workers, and we're just beginning to shift into an analytical world that's basically supervised with advanced analytics and robotics and AI. We're now eliminating knowledge workers. We don't need all the accountants, the attorneys, the radiologists. We can do it with the software.
29:19

So the question then becomes, in a world where we're heading towards zero marginal cost labor, what do people do throughout life, if they're no longer needed in the marketplace? In the mid-term, short to mid-term, we have one silver lining. There's going to be one last surge of mass and professional wage labor in the next 30 years, one last surge. That's to do the build out of the internet of things. It takes labor intensity to build out this infrastructure.
29:49

In Germany, when we got 10% green electricity, we'd already created as many jobs-- 350,000 jobs-- as the entire rest of the energy industry combined, only at 10%. So we have to build out and change the whole energy system from fossil fuels and nuclear to renewables. We have to convert every building in the world, existing and new ones, to your own power plant. We have to insulate them,

seal them up, get them efficient, and put the technology on.

30:16

As I say in Germany, we've done a million buildings, and lots of jobs. We have to transform the entire electricity grid of the world from servomechanical to a digital laterally-scaled internet. That's a huge amount of professional and semi-skilled and skilled work to lay it down. And we have to put in the automated logistics and transport network, and change from internal combustion engine transport to driverless fuel cell vehicles. So in the next 30 to 40 years, we have to do the build out.

30:47

My global consulting team, TR Consulting, has some of the major companies in the world involved-- logistics, IT, electronics. We're actually working with entire countries and regions in the world right now, and laying out this internet of things Third Industrial Revolution. It's not academic.

31:06

Where will the new jobs be?

31:07

Well, first of all, if millions and millions of people are producing and sharing their own energy in 3D printed products and information goods, they're going to need less income at zero marginal cost. They're still going to need employment. If the marketplace doesn't need them, because we can produce the energy and the products in the marketplace with just high technology, where will you get the employment?

31:33

In the social commons. The social commons creates social capital, human beings with the other human beings, creating communities-- cultural, sports, arts, wellness, health, quality of life. Those are, the more important employments. Making widgets is not as intellectually challenging and motivating to the young mind as it is trying to create a sense of human community, a sense of transcendence and sense of finding meaning in the world.

32:00

Between 2000 and 2010, the social commons grew by 42% in revenue. The GDP grew by 16% in revenue. Did you catch that? It's already happening. And in the last 15 years, employment in the social commons kept going up, up, up. Employment in the marketplace kept going down, down, down. And during the Great Recession, employment in the social commons went up. Employment in the marketplace went down.

32:33

When you survey high school kids, it's interesting where they want to be-- the millennials, not the X'ers. Because the millennials have gone through the Great Recession. And this is kind of a different group now. They asked 9,000 honor students, the best and brightest high school students, last year, what kind of employment do you want? And they said, we don't care so much about the money. We want meaningful jobs that challenge us. And when they surveyed 200 companies or institutions they could work for, many of them chose those institutions that were in the social commons. And do you know what the number one institution they all chose to be employed in, 9,000 honor students? It wasn't Google. It wasn't General Motors. It was St Jude's Hospital. Isn't that interesting? I wouldn't have even gotten that. A hospital where you go in, you don't pay, and you are provided for. Interesting.

33:28

Now, economists will say, well, wait a minute. Isn't this social commons a parasite? It isn't a self-sufficient sector, because it relies on government grants and private philanthropy to maintain itself. That's a myth. The Johns Hopkins University survey of 40 countries shows that 50% or more of the revenue in the nonprofit social commons world is fees for services rendered-- health care centers, educational organizations, environmental groups, et cetera. Only 35% of the revenue comes from government entitlement, and maybe 10%, 15% from philanthropy. Well, on this scale, you'd have to then ask about the marketplace. Because 36% percent of all the GDP in the United States goes from

the government taxpayers to private enterprise so that they can engage in building out things that we need. So is that parasitic? We provide more for them than we do this sector.

34:26 - So I think what we have here is a very interesting dynamic unfolding. It's going to raise very substantial questions about who will control this internet of things. Will it be open and transparent? And let me say, Google has a very big responsibility here to lead. We are very worried about network neutrality. And I know you are, as well. You know, network neutrality was critical to the idea of the World Wide Web. And if we're having an internet of things without network neutrality, it fails. It will be enclosed, privatized, monopolized, and we will not get to a near zero marginal cost collaborative commons world.

35:04 - In January, the US Court of Appeals-- the second highest court in the country-- five to four, you can guess the vote. They struck down network neutrality, the central principle of the Federal Communication Commission overseeing the internet. Because they said this was not within their mandate.

35:22 - So now the FCC has to go back and try to recast this idea of network neutrality with new protocols. But already, as you well know, the cable and telecom companies are saying, wait a minute, we own the pipes. We're getting tired of this. We want to make sure that we get some return here. So we feel we ought to be able to charge different prices. And network neutrality means everyone's treated the same. You get a service provider, you go up there. No one's left behind. No one's put at the back of the line. No one's put at the front of the line. But now the telecom and cable companies say, we want to change that. We want to provide different kinds of premium services. So we can discriminate and decide who gets what, and on what time schedule. And we even would like to control some of the data. It's going through our pipes.

36:09 - So it's going to be essential that the internet companies that have brought us this social commons make sure that we keep an open network neutrality.

36:18 - Now let me say one more thing that may step on a few toes here. I love Google. I use Google every day. I don't know what I'd do without Google as a research tool for my office. I love Facebook. I love Twitter. I use Amazon. But we are now reaching a point now where these institutions which have provided the social commons are starting to look like global public utilities, social utilities. There's what, six billion queries on Google a day, I think? And I think you're about-- I think you're around 67% of the research engine market in the US, and 90% in Europe. \$50 billion in revenue, you're doing well. And then you take a look at Facebook, one out of every six people on the planet almost is on Facebook. That's amazing. And Twitter, you have 640 million people. And on Amazon, one out of every three purchases start on Amazon, including mine. So we love these internet companies, because they've allowed us to create, and began to facilitate a collaborative commons.

37:20 - But we're going to have to find some way as you mature as global institutions that there's the appropriate regulations both internally and externally to make sure that we facilitate open, transparent sharing on this collaborative commons. And that's the responsibility of a younger generation and Google to make that happen. Then we can have the best of the new world.

Last thought. I think is going to be a rough road. I have to tell you that the real wild card here's climate change and cyber terrorism. The latter is more addressable than the former. We can get to nearly free energy. We're already there, nearly free goods and services. But without food and water, we don't survive.

38:03

What's terrifying about climate change is it changes the water cycle of the earth. That's what this is all about. It's not well-known in the public, but for every 1 degree that the temperature goes up on the planet from climate change from industrial activity, the atmosphere is absorbing 7% more precipitation from the ground. The heat sucks up that precipitation so you get more dramatic and concentrated precipitation, and more violent water events, more violent winter snows, more violent spring flooding, more prolonged summer droughts, more category 3, 4, and 5 hurricanes, tsunamis,

and typhoons. Sound familiar? And here in California, drought, the breadbasket of the world. And we don't know if we can even feed people and provide water for people.

38:51 - How do we repopulate millions of people in the western part of the US in 30 years? So climate change is the elephant in the room. What's important to acknowledge here is that the Third Industrial Revolution, this internet of things, allows us to move quickly out of fossil fuels and have millions of people begin to produce and share their own green energy. And this internet of things, because its entire purpose is to increase efficiencies, to reduce marginal costs, it means it shows us how to use less resources more effectively so we don't put a big burden on the planet that we live in.

39:31 - So we have young people here not only sharing information goods and energy now, and 3D printed products. We've got young people sharing cars. The front page of the San Francisco paper today is providing parking spaces for car sharing services. Young people don't want to own a car. They just want to have access to mobility. And for every car you share, we take 10 cars off the road. And when we move to electric vehicles shared, we move to clean energy. And we have young people now sharing their homes and apartments. The big issue in San Francisco this week? Airbnb. And Airbnb's success is near zero marginal cost. They have the web up. That doesn't cost them anything after they put it up. And how much does it cost somewhere, who owns an apartment or a home? They've already covered their fixed cost. They're paying their mortgage. The marginal cost in renting out the room is near zero. How do the hotel chains compete with that? They have to put together a physical room. That costs money.

40:22 - But so we have car sharing and bike sharing. And now we're sharing apartments and homes and clothes and tools and toys. So we have a generation that's beginning to believe it's not about ownership. It's access. And if more people share what they have, less has to be produced. It does have a negative impact on GDP. But it has a positive impact on quality of life, and that's the way to measure a good economy. Last thought. It isn't just about technology.

40:50 - Google is a tremendous place to be. You've provided a lot of technology that's really helped us create a better world. It isn't just technology. We need to change the human narrative. We need a new story for the human race to go with the technology coming out of technology places like Google.

41:11 - We have to move from geopolitics to biosphere consciousness in one generation, or we're not going to make it. I'm telling you, I'm almost 70. Some of you in your 20s and 30s, I really shudder at the possible world we are creating with climate change, unless we reverse this quickly, really quickly.

41:29 - What is the biosphere? That's the sheath from the stratosphere to the ocean depths, where-- 40 miles-- where all life interacts with the chemicals of the planet to maintain this Earth and life on it. I'm guardedly hopeful, because we have young 15-year-olds coming home from school, and they actually have biosphere consciousness, a new thing. They're asking their parents, why do you use so much water when you're in the bathroom? Why do you have the TV on? We don't use it. Why two cars? Why not car share? And here's the one I particularly like-- why is that hamburger on my plate? A lot of 14-year-old kids aren't eating. They're on strike. Did the hamburger come from a tropical rainforest in Central America? Did they have to destroy the tree canopy for four inches of topsoil for my burger? And the kids are smart enough to know that those trees are the habitats for rare species that go extinct when the tree canopy is knocked out. And the kids also understand when the trees are knocked out to graze the cow for the burger, the trees are no longer absorbing CO2 from industrial climate change. So the temperature of the planet goes up, and some farmer, she can't feed her kids because she has floods and droughts on her land. They're learning ecological footprint. It's a metric. They're learning that everything we do intimately impacts some other human, some other ecosystem, some other species on this Earth.

42:48

So I'm guardedly hopeful. We've got a young generation here that's beginning to see we live in one indivisible community, the biosphere. And if we can facilitate the process where the Googles of this

world can help connect us in a neural network so that we can dramatically increase efficiencies, reduce our marginal cost, and that means using less resources more effectively and taking a less burden on the planet, we may get to a better world by mid-century. I don't know if we will. You will be the judges on your watch. So it's essential that Google, and the other companies like Google, you need to help lead this so we have a chance of rehealing the planet and creating a future for our children. Thank you.

You want to do a few questions?

43:39

AUDIENCE: I'm not an economist.

43:41

But I thought I had a good understanding of what zero marginal cost meant.

43:45

JEREMY RIFKIN: Near zero, it's near zero.

43:46

AUDIENCE: Near zero. But at least-- so I have two questions on this.

43:51

With regards to energy, you kept talking about solar. I have solar on my house. It's not zero marginal cost. I cannot produce more energy that I want without putting on more panels, which has a cost. But it's zero in the sense of I'm not consuming things-- like with coal, right? So I wasn't sure which of those two distinctions you were talking about, and how you get to zero in that regard. And then I didn't understand it at all in logistics, because as far as I know, you still have to drive miles. And that cost isn't really changing.

44:20

JEREMY RIFKIN: Let's talk about the solar panel or the wind turbine or the geothermal heat pump. You have to pay the fixed cost of the harvesting technology. It probably is going to take you somewhere between three and nine years to pay back on the solar panels. But the moment that channel's up, you keep it clean, the sun is free. Coal is not free. Natural gas, shale gas, uranium? None of that's free. But the sun is free. You just capture it. The wind is free. You capture it. The geothermal heat's free. You capture it. So in that sense, it's near zero. But you're only advantaged if you're in an energy internet that's part of an internet of things. Because you may have a lull one day where the sun isn't shining, and you haven't stored that green electricity. Or maybe the wind's blowing at night, but you need electricity during the day. So we have to create an energy internet that crosses continents. And that way, let's say in Eastern Europe, where it's night time, they have a lot of wind? The surplus goes up on the energy internet to the places which are still daytime. Or if you have a lot of sun somewhere in Europe, in Western Europe, during the day, you put the surplus up on the net and that energy, and then it would take it to another part of Europe. So these energies are intermittent. And they change in different times of day in different parts of a continent. To the extent that we have an energy internet, we can share our surpluses when other has lulls. And we can-- if we store it correctly, hydrogen and other storage technologies-- we can deal with peak loads, base loads across continents. That's we're attempting to do in Germany and in Europe right now. And I was just in China. That was a big surprise to me with China, because I didn't think they were going to be players. "The Third Industrial Revolution," my former book, was published there two years ago. And the new premiere read it in English, and instructed the government to now move on a distributed energy internet and to move toward an internet of things. I was there in September with the leadership. 10 weeks later-- 10 weeks later-- after my meetings with government leadership, the Chinese government announced an \$80 billion four-year commitment to move the distributed energy internet across China so everyone could produce their own energy. By contrast, the US is going to try to raise \$3.5 billion over 20 years for a centralized smart grid. So I'm guardedly hopeful. But I think that these are real challenges. And for you, the challenge is your up-front cost. So you can pay them off, and get to your marginal cost being nearly free. It's a challenge.

46:48

AUDIENCE: What about the logistics?

46:49

Can you explain that?

46:50

JEREMY RIFKIN: That's the newest one, that's the newest one. And I deal with that in the book. It's brand new, last 24 months. We're dealing with now, in Nord Calais, we're doing a master plan for the oldest industrial region of France. And they have Dunkirk, a port facility. The logistics is the most inefficient part of the value chain. That's why it's costly. You have freight across the country. 0 When you see a truck, sometimes it's only 20%, 30% full. Or it's dead and heading back with no cargo. It's not systematized. It's not efficient. What we're looking at now is a transport and logistics automated internet. And this would allow you to have everything modularized so that you can move shipments to any distribution center you want. For example, there are 5,000 warehouse is in the US. So what? If you're a big company, vertically integrated, you own maybe 20 of them. So you have to send your stuff way out of the way, hold it there, and then take it to the destination. But what if all 5,000 warehouses, privately-owned, came together in a cooperative? So when they had space, it would be open to anybody. You follow me? Then with 5,000 distribution centers, you could move to whichever one you wanted, and save a huge amount of your transport time moving it through the system with GPS guidance. But you'd have to have all the containers modularized. Everything would have to be on the same standards, so you can move the package across that internet like you move all the packages across the communication internet. And then if you can move to driverless vehicles and drones, that's going to reduce your labor costs substantially. So you'll get toward zero, but it'll still be marginal cost, but fairly low compared to the cost we have now. It's exciting. We're just beginning this discussion in the last 24 months. We're laying down the first plan in northern France now. So we're on a learning curve.

8:42

AUDIENCE: Hi.

48:43

I have two interrelated questions. One is, you're mentioning Europe, United States, and China. How about other countries, maybe in the developing or emerging nations, either because of the access to technology, or because their economical situation? And the second question would be, how about the disparity between any given society between those that have a lot and those that have little in the present? Is it going to be different in the next economic system that you envision?

49:16

JEREMY RIFKIN: In the business community, we did not see cell phones coming to sub-Saharan Africa and rural India. We didn't. It was never in the equation. All of a sudden, without any marketing, millions of people starting getting cell phones. Then the cell towers came. And what we realized there was the liability in the developing world is actually their asset. They have no infrastructure. It's easier and quicker financially to build from scratch then to mend an old infrastructure. It's like a home. My wife and I have a beautiful old home. We spent 24 years trying to renovate this home. It's a big entropic pit-- sorry, honey--but it's an entropic pit. Had we built a new house from scratch in six months, much cheaper.

50:00

So the United Nations has embraced the five-pillar, Third Industrial Revolution plan we've laid out toward this internet of things. Why? They think the developing world can move quicker. Now in rural India, in the last 24 months, and now sub-Saharan Africa, young people your age, startup companies, are all over the map in the rural areas. And they're setting up little micro grids. \$2,000 for a village, you wire up the huts. You put solar panels on. You lease the panel. When it's paid back, it's yours. And a village, a small village of several hundred? \$2,000. So you can set up micro grids, and it works like Wi-Fi. You start connecting these small players together, and all of a sudden,

you have a network. Just like a Wi-Fi network, you have a near zero marginal cost energy micro grid network, and you create from the bottom out, not from the top down. That's beginning to happen. It's pretty encouraging.

As to the haves and have nots, let me say, I taught the advanced management program at Wharton for 16 years, our CEO program, nearly 16 years. We all believed-- in the First and Second Industrial Revolution, we had to vertically integrate our business activity.

Every society needs three things in order to organize itself as a society--a form of communication, a form of power, and a form of mobility. When communication comes together with energy, they create new systems. For example, the 19th century, the communication, we went to steam-powered printing-- cheap, efficient, mass-produced printing-- and the telegraph. That allowed us to manage a complex coal power industrial revolution. That was the power source. And then we introduced the locomotive for the mobility so we could bring dense urban areas together and create national markets. 20th century, Second Industrial Revolution, the form of communication was centralized electricity, the telephone, then radio and television, to organize a power source-- oil--and a new mobility factor called the internal combustion engine. The Third Industrial Revolution, the communication is the internet and the internet of things. The power source is the energy internet :09 and renewables that are distributed energies. And the mobility is an automated, driverless transport and logistics system in one platform.

52:18

So I think the trend lines are there. But what it allows us to do now is eliminate vertically-integrated global companies where-- they were essentially in the First and Second Industrial Revolution, because they reduced marginal cost. They eliminated a lot of middle men. You put everything under one roof. But now the internet of things allows millions of people to even bypass those types of vertical organizations, scale laterally, eliminate all the middle men, and you directly engage each other. That's what the internet's about. Millions of people go up there in lateral economies of scale. They are bypassing-- thanks to Google and all these others--they're bypassing all the middlemen with information goods.

52:56

Now they're going to be able, with these lateral economies of scale, to also move to the world--the physical world-- energy and 3D printed products. And so I should say, things like CouchSurfing and Airbnb are just the beginning of this shift. But what it does is it democratizes the economy. And hopefully, you'll be in a world in 2050 that won't be the 1% or the 99%. It'll be a shared economy, a sustainable good quality of life, where no one's left behind. Now, is it Utopia? No. Will we actually get everything I'm laying out? Doubtful. But if we can at least see this as a possible narrative, it's a pretty good journey to be on even if we only get half of it done. And it's a lot better journey than we're on now, where we have a Second Industrial Revolution that's bringing us mass unemployment, a greater disparity between rich and poor, and climate change threatening our survival.

53:48

So I think this new journey is a positive journey. It's going to be fraught with problems and challenges. But it's worthy of your generation to help reheal the planet and create a more just world for all of us, hopefully.

54:03

AUDIENCE: So I had a question again about zero marginal cost--

54:09

I work in manufacturing, and we use 3D printing quite a bit. But the thing that we like about 3D printing is that it's a very low fixed cost in exchange for a much higher marginal cost. So marginal cost for current manufacturing is already very, very low-- much, much lower than 3D printing will ever get. So I guess maybe I'm misunderstanding what you mean by the near zero marginal cost on

manufacturing?

54:34 - JEREMY RIFKIN: My understanding-- of course, the printers are pretty cheap. But they're not very sophisticated. You can get a printer now for \$1,200. The big, sophisticated printers cost more. But you're right. It's an exponential curve. The fixed costs are going to really go down, especially because it's added at manufacturing.

54:52 - AUDIENCE: And this is in a typical, like a traditional manufacturing line.

54:55 - JEREMY RIFKIN: What brings the marginal cost down is its additive manufacturing. I always taught subtractive manufacturing would, in centralized first and second Industrial Revolution factories, you take a big hunk of a material from nature, cut it up, tear it down, winnow it, and then put the product together. And you throw a lot out. All right? As you know, with 3D printing, the software is directing the molten material to, layer by layer, build up a three dimensional product with moving parts. It's additive manufacturing. It uses, what, 1/10 of the material? With additive manufacturing, you are using a lot less materials. But you're talking about the materials themselves.

What I'm saying is that what I've been seeing in the industry-- in Europe, at least-- is they're using a lot of recycled plastic now, which is very low cost. And they're now using, as you know, in the Scandinavian countries they're using recycled paper, which is low marginal cost.

55:51 - And we now have some printers that are using gravel, rocks, and sand for various things, which is just locally available. I think it's going to be a while. This is so new-- and you're at the cutting edge of it here--it's going to be a while before 3D printing is on center stage. But at least the kind of work you're doing, I'm sure you feel very positive that it's going to lead to a new kind of manufacturing that's going to reduce both fixed and marginal cost down the line. It's going to take a while. Otherwise, why do it? I'm hopeful that here at Google, help lead us into this new world.

56:25 We need to join together, all the people on the planet, with this new technology, and hopefully create some hope. Because I see a lot of despair, a lot of cynicism, a sense that nothing can happen. But we're right now on the cusp of a great economic revolution, this shift to the collaborate commons and an internet of things platform that allow us to begin to produce and share goods and services with low or zero marginal cost, and in a sustainable way for the planet. It's the journey we all ought to be on.

