

MEDIA EDUCATION FOUNDATION

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BLIND SPOT

Peak Oil & the Coming Global Crisis

Transcript

PEAK OIL

RICHARD HEINBERG: We humans have been using energy for as long as we've been around; we extract energy from our environments in various ways, food is the most basic form of energy and then we exert energy into our environment by way of muscle power. We've been doing that for a very long time and gradually using our intelligence, our opposable thumbs, language, all of these special gifts. We've been able to increase our ability to extract energy from the environment, by way of fire, agriculture, harnessing animals to carts and sleds and all kinds of things, but with fossil fuels we came across an energy source that was far beyond anything we had been using previously. Those of use who are alive today take fossil fuels for granted; we've always had them around. Doesn't matter if whether you're 20 years old or 70 years old, we've all grown up during this unique, historic period of cheap abundant energy from coal, oil and natural gas. Even 150 years ago, something like 65% of the work being done in the American economy was being done by horses, oxen, mules; another 18% or so was being done just by human muscle power, and the rest, less than 20 % of the work getting done, was being done by fuel fed machines. Now, virtually all the work is being done by fuel fed machinery. The contribution to muscle power is virtually nonexistent by comparison. Imagine pushing your car 20 or 30 miles, that's what we get from a single gallon of gasoline that we pay maybe \$2.50 for, that amount of work is roughly equivalent to 6-8 weeks of hard human labor. Imagine getting 6-8 of hard human labor for \$2.50. That's what we've gotten used to.

LESTER BROWN: I think it's fair to say that oil is the lifeline of our modern global economy; it is the principal energy source sustaining our civilization. The problem is, with the last 25 years or so, world oil production has exceeded new oil discoveries, so the reserves of the oil in the world are now shrinking, a and shrinking reserves will soon convert into declining production. This new world, with declining oil production, which could begin any year now, could be this year, next year, five years from now, but I think its close, its immanent. And its going to create a world very different from any we've known before, simply because throughout our lifetimes oil production has always been increasing. I think the world of declining oil production will be so different from the one of rising oil production and oil use that we'll hardly recognize it. It's going to change almost everything we do, almost every facet of our lives and almost every sector of the economy.

When historians write about this period they may use the nomenclature 'BPO' and 'APO', before peak oil and after peak oil. So I think there's been a public information campaign to discourage the world from gearing up and seriously preparing for a world in which oil production will be declining.

RICHARD HEINBERG: Peak oil is a term that's used pretty frequently to describe the time when the world's rate of oil production is going to reach a maximum and then start to decline. Now the reason that we know that this is going to happen is that this happens in individual oil fields all the time. We find an oil field, gradually being to exploit it, the rate of extraction increases, then when about half of the oil is gone the rate of extraction peaks, starts to decline, and the tail end could go on for a very long time, but it will never reach the same rate of extraction that it did when it was at peak. The same is true of whole oil producing countries, like the United States. The U.S. used to be the world's foremost oil-producing nation back in the early part of the 20th century. Us reached its peak of production in 1970, it's been declining ever since. The same is going to happen to the world as a whole, no one disagrees about that. There is some controversy as to exactly when that's going to happen. But everyone agrees it will happen, and when it does, it will change virtually everything about how we live in the modern world, because without energy nothing happens.

ALBERT BARTLETT, PH.D: No matter how you cut it, young people today, you folks, you're going to see the peak of world oil production. And you gotta ask, "ok what is life going to be like when we have declining oil production and growing world population and growing world per capita demand for oil. What's gonna happen?" Well, I think the only thing you can say with some reasonable assurance is that prices are going to go up. And I think the recent price increases that we have seen for liquid petroleum are just a harbinger of this; it's on its way now. The price goes up and down, its again a noisy system, it fluctuates. Ya know, there's a big hurricane in the Gulf of Mexico, takes out some of the production platforms, price goes way up and the production recovers and prices come back down. But it won't come back down to where it started, and its on a rising trend, and I suspect you'll see this trend rising very, very rapidly as we go past the peak.

FOOD AND FUEL

TED CAPLOW, PH.D: Food and energy are, and always have been very closely related. Today, we use an incredible amount of energy in agriculture. Many many times what we did before industrialization, and more and more energy all the time. If oil prices were to dramatically rise, say they were to double over night, you would see broad impacts rippling through the agricultural sector, because the agricultural sector depends on energy. Farmers would be paying more for tractor fuel, truckers would be paying more for truck fuel, and the price in the super market would have to go up so those industries could survive. So an energy crisis becomes a food crisis. The other thing that is happening today between energy and agriculture is bio fuels, so for instance in this country we grow a lot of corn for ethanol, and as the cost of petroleum fuels rise, the competitiveness of the energy crops rises. So a farmer would be more inclined to grow corn for ethanol than

they might be to grow a food crop because ethanol competes with petroleum fuels. So, there's kind of a two-pronged effect.

DAVID PIMENTEL, PH.D: The U.S. Department of energy put me on a major committee as an advisor to the secretary of energy, and he at that, way back in 1980, asked me to chair a study on ethanol, because it was so much conflicting information. And I must admit it still remains conflicting today. All of these studies have documented that the energy inputs to produce ethanol, well biodiesel, from corn, from soybeans, from switch grass, wood, and so forth, all have turned out to be energy negative, that is it takes more energy to produce a gallon of ethanol and/or biodiesel than the energy that is contained in the biodiesel and/or ethanol. We have some people in the USDA who felt that ethanol, despite the data that we put together, could be very helpful and they sold the politicians this bill of goods, ignoring the ethics of burning food to produce fuel and the problems in the world where we've got 3.7 billion people who are malnourished on earth today, the largest number ever in the history of the earth.

BILL MCKIBBEN: One of the ways that you can tell, one of the sectors where you can see most easily how fossil fuel has transformed our way of life in this country is when you consider that a century ago half of Americans were farmers. Now that number is under 1%. The census bureau no longer, you can't even check off 'farmer' as one of your occupations, because there aren't enough people to make them worth it listing it; there's a lot more people in prison than working on the farm. In the first place, there's a lot of people who would like to work on the farm and have been chased off it by the endless commercialization of our culture. But in any event, what's impossible is continuing to spend 30 calories of fossil energy to bring one calorie of lettuce from California back to the east coast. We've substituted oil for people, that's what's happened between big tractors and synthetic fertilizer. We have lots of oil doing the work of lots of people. That's had some benefits; we have incredible amount of cheap food. But as we begin to understand, even in the last few years, even that's not the greatest benefit in the world, its one reason why Americans are now fat, and we have too much of that stuff. So, we're gonna have to stop taking for granted our use of energy. On the one hand, at least as it comes to oil, its not gonna be there anymore, ya know, we're beginning to run out and its not gonna be at the very least cheap anymore.

MAX FRAAD WOLFF: From about 1830 when our first data that's of any value starts, to about 1970 in every decade, actually including the great depression, average real wages in the United States rose, some more than others. But the 1980's and 1990's are unique because they didn't. And so it's an unprecedented extended crisis in the middle class real wages of this country that we're now in the third decade of. There's definitely a connection between the stagnant to falling real wages and the oil shocks and oil peaks in the mid 70's. One way that you can systematically redistribute the wealth of a society is to have the wages that the mass of people earn not rise as fast as the things they buy. So they're nominal, they're dollar wage, what it says on your check, that may be going up, slowly but going up. The problem is your real wage, or what you can buy with your money, doesn't. This is easiest and most commonly done when there's an inflation. When the prices suddenly rise so that in order to keep up your wages would have to zoom up,

but when we suddenly have a surge in prices, which we did in the mid 70's with oil, it's very rare to see a whole lot of big wage increases because corporations are pinched by the rising cost of energy, and this pushes down what people's wages can buy. So the long, serious decline in the average wage for the average American began with the oil shocks and the inflation there, and it never really recovered. There have been some good years, but, in fact, cheap imported goods and debt are the single two biggest supports of the average American's material standard of living. Anything that interferes with the ability of Americans to continue to go deeper into debt or to get cheap, undervalued imported goods will immediately and probably painfully lower the material standard of living of American middle and lower classes. So they are dependent on that. If Chinese goods were to double or triple in price millions and millions of Americans would face a situation very rapidly where they could no longer afford the basic house wares, clothing, and items that they buy all the time. Particularly at a place like Wal-Mart, which is basically the distribution arm of the People's Republic of China.

ALBERT BARTLETT, PH.D: Archeologists study civilizations that have disappeared. What's a major factor in the cause of those disappearances? One factor is: they grew beyond the capacity of the surrounding country to supply them with food. And you know in olden days you could maybe transport food however far a horse and wagon could travel in maybe a week, something like this, might be a hundred miles, but not farther than that. The average item of food on our table today has traveled 1500 miles from where it was produced, and the only reason that's possible is that petroleum is so cheap. So petroleum is, and we ought to ask, no what's gonna happen as the world goes over the top peak, and petroleum starts its inevitable decline, production decline towards zero. Modern agriculture is the use of land to convert petroleum into food. This isn't high-level mathematics, this isn't rocket science, this is just plain common sense, and it's universally rejected by the business community, the commercial community, the political communities.

HISTORICAL PERSPECTIVE

RICHARD HEINBERG: The biggest question always in my mind was how to understand the Industrial Revolution, because everything up to that point is pretty easily comprehensible; we figured out agriculture 10000 years ago, and gradually the population increased as we spread out across the planet and spread agriculture with us and so on. But then 200 years ago with the beginning of the Industrial Revolution it's like everything goes haywire. The human population goes from fewer than 1 billion to 6.5 billion, and the scale of the human impact on the environment increases exponentially as well. So, how to explain that? Well I tried looking into the history of capitalism, and looking into our mythological, psychological interaction with nature and so on, but then finally in 1988 I read a paper in Scientific American by Colin Campbell and Jean Laherrere, titled "The End of Cheap Oil", and for the first time I began to understand the role of energy in human social evolution. And for several years I studied this and read books, and I realized that this was the key to understanding everything that's happened in the last 200 years, that fossil fuels are the essence of the Industrial Revolution. So that creates a problem because fossil fuels are

inherently finite. Oil was created, ya know, 90-150 million years ago, and we're drawing down that stock of highly concentrated fuel in an amazingly short period of time. What's 200 years compared to 150 million years? And that oil is going to be gone, virtually, by the end of this century. So, the 20th century was all about using more of this stuff, and it was the great petroleum fiesta, one time only in the history of our species. The 21st century is going to be all about how that party winds down. This is the most serious problem to face the human race since we've been human.

WILLIAM R. CATTON, PH.D: Ok, why don't we understand the ecological facets of our predicament and of life in general? Is it just because we are preoccupied with our own personal interests or is it something more serious than that? I think it's both. Obviously when I get into the car and I start up the engine and I step on the gas and I go someplace, I don't most of the time think about all of the effort of all of those people out there drilling oil wells and pumping oil out of the ground and shipping it to a refinery and producing gasoline, I just think of where I'm going, and the pleasure I'm going to have, or the purchase I'm going to make, or whatever. So preoccupation with the routines of life is of course a major obstacle to people thinking the things that it's becoming increasingly important that people do think about it. But in addition to that, we have been through a period of history in which expansion was tantamount to progress. The fact that every little town aspired to be a city, and the fact that the country was growing and becoming more powerful, and the fact that we were becoming more prosperous, and we compare ourselves with our colonial ancestors and we think, "oh what great progress we have made" and so on. It means that the whole approach to the study of history has been a non-ecological approach; we have simply been preoccupied with the political aspects of it and with the economic aspects of it, with the fact that we advanced from being an agrarian society to being an industrial society.

JASON BRADFORD, PH.D: This faulty premise that we can always keep expanding human population and human consumption of resources, how does that perpetuate? I think what it happens is this, is essentially you have this, this physical reality based upon the availability of fossil fuel energy, which essentially allows us to raise our short-term carrying capacity of the planet tremendously. We are able to now organize the resources of our planet to support more and more people, and more and more consumptive lifestyles, to a point where its gone on for so long, and we've met so many challenges that in an essence we developed a culture that reinforces the idea that there are no real consequences to our actions, because even if there's a short term problem we'll have the ingenuity and the ability to solve it. This society in general then has generation after generation going back with that belief system, and those set of expectations. And so to be able to turn that around when all anyone who is alive today can see, is just, ya know, this era of human progress that goes back to the past and they assume it's going to stretch out to the future. And it's embedded in the laws and the habits that people have, its just sort of a positive feedback loop. So there you see this cultural constraint then on change that becomes very very dangerous, because when that is challenged, its challenging generations of belief and assumptions. And what happens is that those who challenge it are essentially putting themselves outside of their own culture, and that becomes very difficult to handle as an individual psychologically and emotionally, because you're

constantly gonna be looking at your own culture and saying, "Oh my gosh, it's crazy. It's crazy." And yet the culture will look back at you and say, "you're crazy."

JOSEPH TAINTER, PH.D: When I looked at what happened to ancient societies over long periods of time, I realized that the challenge they faced was the cost of their societies becoming more and more complex. As these societies faced problems, whether it was problems of external enemies, or problems of managing their own environment, they would tend to develop more complex institutions. Very often they spent a larger military, a larger government, more control over their people. And these societies tended to tax their citizens more heavily to pay for their complex problem solving. Well this had lessons for today, obviously, because we have the most complex institutions of problem solving that existed on earth, that humanity has ever developed. The difficulty with complexity is that it always costs, whether we're talking about organisms as they evolve to become more complex, or societies as they evolve to become more complex. In past societies the problem was that complexity would increase beyond that point that was sustainable with the solar energy that ultimately supported them. We have to remember that they didn't have the fossil fuel energy we have today. So ultimately they reached the point where their complexity of their societies could not be sustained on the basis of solar energy, on the basis of agriculture. When I look at the unindustrialized world today, and try to project how it might develop over the next few decades, what I see are a large number of very expensive converging at once. We have not only the problem of energy that is so prominent today, but we have problems involving such things as an aging population, and funding the penchants for the people of my generation. We have problems of decaying infrastructure that needs to be maintained and replaced; we have the continuing problems, a very high military cost. In ancient societies that I studied, for example the Roman Empire, a great problem that they faced was when they would have to incur very high costs just to maintain the status quo, invest very high amounts in solving problems that don't yield a net positive return, but instead simply allow them to maintain what they've already got. This decreases the net benefit of being a complex society, and so ultimately it was very costly to be the Roman Empire, and it was no longer worthwhile. So the immediate problem that I see for our future is great difficulty maintaining the standard of living that people in industrialized nations are accustomed to, and the social and political unrest that may follow from this.

THE ECONOMICS OF CONSUMERISM

MAX FRAAD WOLFF: The United States of America is where everything gets sold. More or less one out of little over three dollars privately spent on consumption in the whole world is being spent here in the United States. That's kind of staggering. Our job in the world is to buy everything. So we have 4 ½ of the world's population and we do a little more than 30% of the world's private consumption. And the global economy relies on the United States as the consumption point. So more or less when we ran out of our own money they were happy, and in fact, had to lend us our own money back to keep buying, because there's no other place for the world to produce, export to, and to have to all that consumption. We are that place. And the weird specialization of the modern post 1970s

international economy, where the consumer of first, last resort for a significant portion of the world. And so they'll loan to us, so long as we'll borrow, so long as we'll spend, so they can keep producing.

RICHARD HEINBERG: We've been advertized into being the worlds greatest consumers, Americans aren't sort of genetically pre-disposed to being consumers, we are, I would say, victims, of the greatest propaganda system ever devised in human history, which is the modern advertising industry, something like 2 billion dollars a year spent to convince us to buy, use, and consumer, and we've gotten to think of this as normal, growth as normal. We've experienced it for the past coupled of hundred of years and we project that into the future and think that this is normal life. Well there's nothing normal about it.

MATT SAVINAR: You've got an entire generation that has been brought up in a completely artificial environment where their beliefs have been shaped by television, which is designed to sell things like huge SUVs, and in by movies, which are completely disconnected from reality, particularly here in western culture, where ya know, the good guys always win, and there's always a happy ending and so on and so forth. I don't think they understand that everything we do revolve around consuming massive amounts of oil, all our food, transportations, most of our jobs, our social niches that we occupy, all revolve around consuming massive amounts of oil. So once you're aware that the oil is going to become very scarce, a lot of these social niches are going to disappear, a lot of these things that we take for granted are going to severely contract or go away altogether. And yet you're living in it right now and nobody else really seems to be too concerned about it, the cognitive dissonance, ya know, it can be pretty severe. Because in America we are consumers, so all we relate to is, ya know, celebrities and the media, and I do think it's sort of on purpose, because if you're an automobile manufacturer, and television station A starts running all these programs about all the economic and energetic and environmental issues we're facing, they're not gonna get as high a return on investment as they would if they sell as on another television station that's talking about how wonderful everything is, or is only talking about celebrity this and celebrity that. So, it's sort of, I don't know if there's anyone sitting around planning, I wouldn't be surprised if there is, but it sort of works out that way that what tends to sell stuff the most happens to be stuff that also turns the viewer into a bumbling idiot.

ELKE WEBER, PH.D: Probably one of the most social questions is how to change behavior. And one of the reasons why behavior is so difficult to modify is that so much of it is automatic. We just react to our current environment; we do things by habit the way we've done things thousands of time before. But if you think about making decisions to change your consumption patterns in order to provide a better environment for future generations, in order to reduce, you know, CO2 emissions. That it involves trade-offs, trade-offs between getting benefits now and getting other types of benefits later. One thing that you find is that people are incredibly impatient as soon as one of the options allows for immediate consumption, immediate receipt of something that they value. So a blind spot is something to which we don't pay attention because it's often times removed from us either in time or in space, and therefore it doesn't threaten us in any immediate way.

BILL MCKIBBEN: There's plenty of interest in this society that would like to keep anyone from ever finding out anything about this. I mean the fossil fuel industry spent most of the last 15 years funding every absurd, disinformation campaign they could think of, and fairly successfully. But one of the reasons they were so successful was because we didn't really wanna know the truth either, you know, it's a good deal easier to lie to people when they're happy to have you lie to them. It's extremely threatening to us, because more than any other country on earth, we've taken the logic of cheap fossil fuel and run with it, more than any place else our lifestyles reflect that dependence on cheap oil and cheap energy. We live in huge houses, we drive huge distances; we're gonna feel that pinch if we start to change. We've become highly, highly individualized. That's what it means to live two people to a 40 thousand square foot house, a quarter mile from your nearest neighbor on some enormous subdivision.

MATT SAVINAR: Our culture in this way is unique in that we're completely atomized and isolated. Moat folks who are born here and live here their whole life, their very neural connections in their brains are formed within a very high energy, high tech society, and I'd say in the last 20 years or so, as our society has sort of become too complex for its own good, more and more people, because they're kind of getting tossed by the waste side, I dunno you start thinking, "something's not right here." And since we're atomized people don't start talking about their experiences with other people because they've sort of been shamed into it through what they watch on television and the rest of the media. And so you got a lot of people who the greater society's not serving them, and they're sort of feeling left out, but they're not talking to anybody about it, because they think they're the only person, or they're somehow in a minority, and they're actually more in a majority than in the minority.

ECOLOGICAL COLLAPSE

LESTER BROWN: I see the oil situation as part of a much broader situation, where we're pressing against the limits of many of the earth's resources. We see this now in commodity market prices, for example, we see it in copper prices, I could go through a long list. But I'm concerned about how we're pressing against the limits of all the earth's resources, both renewable and nonrenewable. I'm concerned about the water situation and the extent to which we're over pumping aquifers around the world. Half the world's people live in countries now where water tables are falling and wells are starting to go dry. I'm concerned about the excessive demands on forest. I'm concerned about climate change and that fact that we're discharging so much CO₂ into the atmosphere from burning fossil fuels that nature cannot absorb it. So, if everyone in the world consumed at the same rate of the average American we would need three planets. The problem is we only have one.

JAMES HANSEN, PH.D.: If we follow business as usual with 3 degrees Celsius global warming, the arming on Greenland and west Antarctica would be enough to have a lot of summer melt and once the ice sheets start to soften up and begin to move we could get

sea level changes of several meters in a century. The big danger about ice sheets is the positive feedbacks that exist; as it starts to melt it becomes darker and that means it absorbs more sunlight, so that's one positive feedback. But also as the ocean warms it melts the ice shelves, which exist where the ice streams exit to the ocean. And so that opens the gate and the ice streams move faster. And it lowers the surface and that makes the surface warmer, and as sea level rises that will lift the ice at the mouth of the ice streams, and especially West Antarctica, so that tends to unhinge the ice so that there's the danger that these positive feedbacks will cause a situation that begins to run under its own power, and just runs out of our control, and we end up with sea level rise of several meters, or even conceivably 25 meters, and that would be a global disaster of unprecedented proportions. So the question is, do we want to preserve a planet that resembles the one that we inherited from our ancestors, and if we do want to preserve that planet then there are going to have to be some changes made in the way that we use energy, the rate that we use energy, and the fuels that we use for it.

TERRY TAMMINEN: Many people ask me, you know, "we're a smart country, how could we be this dumb? How could we allow this to go on? Its one thing to have it happen, we all learn, but since the 1950s or 60s we've understood about the harms of oil and the harms of tailpipe emissions, how could we continue to allow this to happen?" And I have a two-word answer: it's politics and lies. The politics are pretty straightforward. As I lay out in my book over the last 10 or 12 years, oil and auto companies have spent 186 million dollars on campaign contributions at the federal level, and that's for congress and the president/ and for every one of those 186 million dollars they've gotten back 1000 dollars in tax breaks and other subsidies. So I think, if you could invest a dollar in something and get back a thousand you'd keep doing it. So that's the politics part of it. The lies part of it is that going back to the 1950s under increasing pressure from regulators, including many right here in California at that time, the auto companies got together, and they said, "ya know what? We'll check our competition at the door on this one issue, about smog coming from our tailpipes, and we'll work together with the automobile alliance that we're now going to create to make sure that our products are safe when used as directed." In fact they boasted that if there was any harmful emission coming from tailpipes that they could engineer that out of all of their vehicles within one model year. And of course the record shows that they formed the automobile alliance to do the exact opposite, to lie to regulators, to lie to the public, to conceal the true science of the harms of their products, and to stifle the production of alternatives to their products; oil and auto companies got together and conspired to kill the electric car, to stifle the development of other alternative technologies that might have brought us cleaner, safer products over these years.

DERRICK JENSEN: There's this great line by Zygmunt Bauman: rational people go quietly, meekly into a gas chamber if only you allow them to believe it's a bathroom. And what he's talking about is that at every step of the way it was in the Jews rational best interest to not resist. Ya know, would you rather get an ID card, or do you wanna resist and possibly get killed? Do you wanna move to a ghetto, or do you wanna resist and possibly get killed? Do you want to get on a cattle car, or do you wanna resist and possibly get killed? Do you want to take a shower, or do you wanna resist and possible get killed? At

every step of the way it was in their rational best interest to not resist, but that's all based on this whole system of make believe you have to make believe that what you know is going to happen to you is not going to happen to you. The same thing is happening today. I mean Zygmunt Bauman says that rational people go quietly, meekly into a gas chamber if only you allow them to believe it's a bathroom, and I'll say that rational people will go quietly, meekly to the end of the world if only you allow them to believe that buying energy-saving bulbs is gonna save the day. So we have all this, and we see this in personal relationships, too, and abusive relationships, ya know? If somebody's in an abusive relationship, they see one little bit of change, it's like "ok, now things are ok!" and then they're not ok, but they see one little bit of movement, now things are ok. And they keep doing this again and again; they have to make believe constantly in order to maintain their place in this wretched relationship. And we have to do it too, we have to believe that the planet isn't being killed; we have to make believe that money equates to happiness; we have to make believe that you can have infinite growth on a finite plan. I mean we could list out dozens of these ways. We have to make believe that the age of oil is going to go on forever, we have to make believe that the people how are living in toxic hell because of oil refineries that they don't exist. We have to make believe that you can kill a planet and live on it too.

RICHARD HEINBERG: In some respects I think population is certainly one of the worst environmental problems because almost anything else we try to tackle, whether its pollution or climate change, or dependence on fossil fuels, ya know, we can make incremental gains along the way, but then as the human population grows it just wipes out anything we do. And then of course having those extra mouths to feed is ultimately a problem because the earth is a finite sphere, and global food production is going to be peaking very soon. Already, per capita global grain production has peaked and is declining. So, the responsible thing to do would be to reign in the human population, gradually, over time, using all the most human methods; increasing levels of education, making birth control methods more readily and cheaply available around the world. But it may be too late for that. It's going to take decades to turn around the problem of global human population.

WILLIAM R. CATTON, PH.D: The kind of atmosphere that this planet has is eminently suitable for human life, one-fifth oxygen and four-fifths nitrogen, and then traces of other gases. But some of those trace gases are becoming more abundant than they used to be, and so we have now the greenhouse effect: in greater quantity we have more carbon dioxide than we used to have and we have some other greenhouse gases that are accumulating that are making the climate of the planet get warmer, which is going to change the distribution of various other species over the surface of the planet; where you can grow crops is going to change, and we're beginning to kill off some of the life in places that we have been accustomed to interacting with existing species, both on land and in the oceans. We're not only overfishing the oceans, but as they warm up there's certain species of sea life that will no longer thrive. There are these examples of other species, of creatures, that exist in finite environments with finite quantities of the resources that they need, and finite disposal space, and so on. And we can learn from the kind of experience that thy have, and one good example is the wine bat, in which the

juice from grapes or some other kind of fruit for that matter, is fermented and turned into wine by the life processed of microorganisms, a form of yeast will do this. And if you think of a crock here in which you've put this mash of grape juice and so on, and you introduce some of that appropriate kind of yeast into it, they multiply, and they consume the sugars that are in that mash, and they convert the sugar into alcohol and carbon dioxide. And the alcohol and the carbon dioxide mostly accumulate and eventually the concentration of those byproducts of life become so great that it kills the yeast cells. So what was, at the outset, a marvelous, unspoiled environment in which they could proliferate and really live it up becomes an environment in which they can no longer exist. In effect that's what we are doing now. We are so changing this planet on which we live, that we might find ourselves in a position very similar to that of the yeast and the wine bat. So, we're not gonna like it, but eventually the population of this planet is going to be a whole lot less than 6 billion. The question that we face is, will it come about through voluntary or involuntary means? If it comes about through involuntary means, how horrendous are those involuntary means going to be?

HOMO COLOSSUS

JASON BRADFORD, PH.D: Most of the assumptions that our society runs on are false; the major ones, the ones that we use to guide our planning, and these then led to habits that we have that lead to very unsustainable lifestyle. We've got a front end and a back end, and the front end goes in resources and the back end comes out waste. And that transformation that happens in our bodies is what allows us to develop and grow. But, as an individual, we all reach a certain growth phase where we reach maturation and then we decline. In our economic system it's the same thing; there are resource inputs to our whole economy, every widget and gismo you hold has stuff going into it that got mined from the earth and transported to a factory and turned into something that we now use, and all that produces waste. And that waster we call pollution. So we have this economic system which has resources going to and pollution going out, and the assumption is that is they can always get bigger. And the problem with that is that it's impossible, absolutely, physically impossible, and yet we set up our institutional frameworks, our financial frameworks, and our habits and expectations as individuals based upon the availability of fossil fuel energy. And so we developed a culture that reinforces the idea that we can always get more.

ALBERT BARTLETT, PH.D: I dropped out of college for a while, and I worked on these iron ore freighters. Ya know, we go up here and get a whole load of however many thousand tons of this iron ore, and haul it down, throw it in a blast furnace in Buffalo, run back up and get some more. And I used to think: will we ever run out? And I can remember saying to myself, "well, Al, you're just a dishwasher. There are smart people in Washington. If there's any dangerous of running out they will act rationally and warn us so that we can reduce our consumption. And I'm ashamed to admit how many years it was before I realized that my trust was misplaced. And I suspect that if you ask any of these people on the street about these problems, you'll most likely find that they have faith that somebody intelligent is looking at these things. And that isn't a justified faith. We have to

do our own thinking for ourselves. We can't let other people do our thinking for us, because a lot of people have ulterior motives, and they'll try and steer us in the wrong direction. A lot of them don't know what's going on even though they're in positions of power. The thing that we miss in this country is a national leader in the white house who'll go up and say, "Hey, this is a problem, look at the numbers." We need to have two years to have a national dialogue on the question, what should our future be in order to live within the resources that we have, and to have a good future for everybody? And out of this two years of dialogue from coast to coast, with political leaders, and leaders in all aspects of life, we're gonna try to come down to some kind of a reasonable policy statement that we'll use for guidance.

MAX FRAAD WOLFF: It's always hard to figure out to what extent global economic change is planned and strategized, and to what extent it sort of emerges as a trend that we who do economics impose on chaos. Honestly, even though it's more frightening, there's no one driving the train. Ok? We're all on the train, the train is moving fast, and we're not even sure where the rails start and stop. So even though it may be disappointing, because some people think in terms more of conspiracy and cabal, I think that it's more chaotic and in some ways more frightening than that, right? So unfortunately saying, "How will we survive it? How do we handle it? How do we see it?" is difficult because it becomes hard to sustain the 'we'. Different interests, different benefits, different costs.

WILLIAM R. CATTON, PH.D: There was a time when human populations were virtually unaware that they were increasing, when the increase was not noticeable within a lifespan. Now it's not only noticeable, but it's appalling. There are three times as many people on this planet now as there were when they launched me. And this is the first time that that's ever been possible for people to say that. And we've also, in addition to becoming more numerous, we have become more voracious, by developing all this technology that makes use of energy from fossil fuels as well as from moving air and moving water, and so on. So that we have in effect changed ourselves from one kind of species into another. *Homo Sapiens* is the name that was given to our species by Linnaeus when he was classifying species, man the wise, ostensibly. I think we've been converted to a new kind of species that I call 'Homo Colossus', because we are no longer just this little two-legged mammal, but, with it's own muscle power can do things. We have all this machinery that can use the power from fossil fuels in great quantities to do things that our own bodily apparatus could never have done, or that even large numbers of us together couldn't quite do. So we are colossal in our impact.

JASON BRADFORD, PH.D: How do you know what you know? Most people know what they know based upon what their culture has taught them over time, unquestioning. And then there are people who actually have to study the raw data and they are trained as scientists to have their belief system based upon evidence, and when that contradicts, ya know, generations of belief, they're just like, "hear no evil, see no evil" ya know, please, get out of my face, I can't handle this." There has never been a time when all these civilizations around the world are essentially linked up through resource exchange in this globalized free trade system that in the short-term gives us amazing economic growth, but in the long term makes us incredibly vulnerable to any shortfall in those resources, to political

instability with any trade partner, and so we spend massive amounts in terms of militarization to make sure that all these people keep trading with us, we set up gigantic banking frameworks and global trade agreements to say, you know, "you better keep trading with us". And that all has a huge cost, too. The bureaucracy has a huge cost. So, this added complexity has diminishing returns, and at some point we're actually gonna need to simplify our management, and localize our management, and make sure that we realign our population both in its size and its location with the biological carrying capacity of the planet. You know, I have kids, I want peace on earth, I want all good things. And yet I found that people that also want those things unable to realize that we're all a huge part of this problem.

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