

Elon Musk speaks on Sustainability at the Université de Paris Panthéon Sorbonne, 2 December 2015. Transcript:

Moderator: Thank you all for joining us, for coming here and also, to apologize to the others who couldn't join because we were fully booked very quickly actually when we launched the invitation. They can follow the livestream if they are not here and you can find the video tomorrow morning on YouTube so we are pretty well organized actually.

Actually, today is a very special day for our university. We are extremely proud and I'm particularly very proud to welcome tonight someone very special, someone who is probably **one of the most influential person of the 20th and 21st centuries, someone who is definitely the most creative mind of his generation.**

He is the co-founder and CEO of a revolutionary car manufacturer challenging the mainstream car industry, but is also the founder and CEO of a tremendously innovative company, actually the first private company to launch and return a space craft from orbit. Last, but not least, also the chairman of the larger solar energy provider in the U.S. Through his different activities, he's facing environmental, social and economic challenges. He deals with breathtaking projects on diverse issues like green mobility, clean and renewable sources of energy, space exploration, so on and so forth.

By the way, among the latest news here, down here in France, in Europe, you probably heard that [02:00] yesterday was inaugurated a new solar firm in the Southern France, something which is definitely or actually the biggest over Europe now selling power at a cost well below the cost of power from the new generation of nuclear reactors and able to provide energy, power for more than 50,000 households. Also and moreover, currently Paris is welcoming the UN Climate Change Conference, which faces the high stake of how to manage with the climatic disruption, the aim of the COP 21 is keeping warming below the 2 degrees Celsius compared with the pre-industrial era. For that, the objective of the COP is to build a Paris Climate Alliance, meaning a universal climate agreement committing everyone. In that context, who better than Elon Musk for conversation with you. Please welcome Elon Musk.

Elon MUSK: Thank you. Hi. Thank you for having me. It's great to be here. Paris is one of my favorite places in the world. It's actually, on the first trip that I went out of South Africa, Paris, that was where I went when I was a little kid. My parents brought me when I was like 6 years old. I've loved Paris ever since. Thank you for having me.

What I'm going to talk about today is just in general terms, [04:00] what is needed to address the climate crisis. This is the thing that if we do, what actions can we take that will accelerate the transition out of the fossil fuel era. Where we are today is ... See, if this is working or not.

All right, we have the present era where we have the carbon cycle. My apologies if some of you already know all about this, but I think some of these things may be not as obvious as they may seem. There's a certain amount of carbon that is circulating through the environment. It's going into the air, and then getting absorbed by plants and animals, and then going back into the air, and this carbon is just circulating on the surface. This is fine and it's been doing that for hundreds of millions of years.

The thing that's changed is that we've added something to the mix. **This is what I would call the turd in the punch bowl.** We've added all this extra carbon to the carbon cycle and the net result is that the carbon in the oceans' atmosphere is growing over time. It's much more than can be absorbed by the ecosystem. It's really quite simple. We're taking billions of tons of carbon that's been buried for hundreds of millions of years and is not part of the carbon cycle, taking from deep underground and adding it to the carbon cycle.

The result is that a steady increase in the carbon in the atmosphere and in the oceans, which doesn't look like much if you look at it on this chart, but when looked at in the context of history, it actually looks like this. So the [06:00] carbon parts per million has really been bouncing around the 300 level for around 10 million years. Then the last few hundred years, it went into a vertical climb. This is the essence of the problem. This is very unusual and a very, very extreme threat as you can see from this rate of growth.

Then this is accompanied by a temperature increase as one would expect. This temperate increase, people talk about 2 degrees or 3 degrees, it's important to appreciate just how sensitive the climate actually is to temperate. It's important to look at it in terms of absolute temperature, not in degrees Celsius relative to zero. We need to say what is the temperature change relative to absolute zero? That's how the universe thinks about temperature. That's how physics thinks about temperature. It's relative to absolute zero for small changes result in huge effects. New York City under ice would be minus 5 degrees. New York City under water would be plus 5 degrees. Looked at as a percentage relative to absolute zero, it's only a plus/minus 2% change.

The sensitivity of climate is extremely, extremely high. We've amplified this sensitivity by building our cities right on the coastline and most people live very close to the ocean. There are some countries, of course, that are very low lying and would be completely under water in a climate crisis. We've essentially designed civilization to be super sensitive to climate change [08:00].

The important thing to appreciate is that we are going to exit the fossil fuels era. It is inevitable that we will exit the fossil fuel era because at a certain point, we'll simply run out of carbon to mine and burn. The question is really when do we exit the era, not if. The goal is to exit the era as quickly as possible. That means we need to move from the old goal with the pre-industrial goal, which was to move from chopping down forests and killing lots of whales. The old goal was to move from chopping wood and killing whales to fossil fuels, which actually in that context was a good thing, but the new goal is to move to a sustainable energy future. We want to use things like hydro, solar, wind, geothermal. Nuclear is also a good option in places like France, which aren't subject to natural disasters. We want to use energy sources that will be good for a billion years.

How do we accelerate this transition away from fossil fuels to a sustainable era and what happens if we don't? If we wait and if we delay the change, the best case is simply delaying that inevitable transition to sustainable energy. This is the best case if we don't take action now. At the risk of being repetitive, there's going to be no choice in the long term to move to sustainable [10:00] energy. It's tautological. We have to have sustainable energy or we'll simply run out of the other one. The only thing we gain by slowing down the transition is just slowing it down. It doesn't make it not occur. It just slows it down.

The worst case however is more displacement and destruction than all the wars in history combined. These are the best/worst case scenarios. Then we have about 3% of scientists that believe in the best case. About 97% that believe in the worst case. **This why I call it the dumbest experiment in history ever. Why would you do this?**

The reason that transition is delayed or is happening slowly is because **there is a hidden subsidy on all carbon-producing activity**. In a healthy market, if you have say 10 Euros of benefit and 4 Euros of harm to society, the profit would be 6 Euros. This makes obvious sense. This is where the incentives are aligned with a good future.

This is not the case today. If you have the incentives aligned, then the forcing function towards a good future, towards a sustainable energy future will be powerful. In an unhealthy market, you have your 10 Euros of benefit, if you have 4 Euros, but the 4 Euros isn't taxed. You have an untaxed negative externality. This is basically Economics 101. You have basically unreasonable profit and a forcing function to do carbon-emitting activity because this cost to society is not being paid. The net result is 35 gigatons of carbon per year into the atmosphere [12:00].

This is analogues to not paying for garbage collection. It's not as though we should say in the case of garbage, have a garbage-free society. It's very difficult to have a garbage-free society, but it's just important that people pay for the garbage collection. **We need to go from having untaxed negative externality, which is effectively a hidden carbon subsidy of enormous size, \$5.3 trillion a year according to the IMF every year. We need to move away from this and have a carbon tax.**

This is being fought quite hard by the carbon producers. They're using tactics that are very similar to what the cigarette industry or the tobacco industry used for many years. They would take the approach of even though the overwhelming signs of the consensus was that smoking cigarettes was bad for you, they would find a few scientists that would disagree and then they would say, "Look, scientists disagree." That's essentially how they would try to trick the public into thinking that smoking is not that bad.

The solution obviously is to remove the subsidy. **That means we need to have a carbon tax and to make it something which is neither a left nor a right issue. We should make it probably a revenue neutral carbon tax.** This would be a case of increasing taxes on carbon, but then reducing taxes in other places. Maybe there would [14:00] be a reduction in sales tax or VAT and an increase in carbon tax so that only those using high levels of carbon would pay an increased tax.

Moreover, in order to give industry time to react, **this could be a phased-in approach so that maybe it takes five years before the carbon taxes are very high so that means that only companies that don't take action today will suffer in five years.** There needs to be a clear message from government in this regard **because the fundamental problem is the rules today incent people to create carbon and this is madness. Whatever you incent will happen.** That's why we're seeing very little effect thus far.

Depending upon what action we take will drive the carbon number to either extreme or moderate levels. I think it's pretty much a given that the 2-degree C increase will occur. The question is whether it's going to be much more than that, not if there will be a 2-degree increase.

Then the question is what can you do? I would say **whenever you have the opportunity, talk to the politicians. Ask them to enact a carbon tax. We have to fix the unpriced externality. I would talk to your friends about it and fight the propaganda from the carbon industry.** That's the basic message I have and I'm happy to take questions.

Staff: We [16:00] have some mikes in the audience being passed around. You want to raise your hand and we'll give you a mike.

Q: Hi, sir. Hey, I'm [inaudible] from the Masteral of Innovation and Technology Management. My question is what do you say to those who think there are more important concerns right now than climate change and global warming?

MUSK: Sure. There are many important issues in the world. This is not the only important issue, but it is I think the thing that will have the biggest negative effect on humanity if we do not address it. Based on the projections that we're seeing right now, these are like I'd say arguably best case projections, we're going to see significant rises in temperature and sea level. The net result is if we don't take action, **we could see anywhere from 5% to 10%, maybe more of the land mass absorbed by water, which maybe doesn't like that much, but about a third of humanity lives right on the coastline or in low lying countries. We'd be talking about maybe 2 billion people being displaced and their homes being destroyed and their countries being gone. I think we should take action.**

Q: Hello, sir. Thank you for coming here. My question is ... I'm a PhD student in Marketing and what I study is what motivates people to participate in challenges. Now you have created a company which creates challenges which brought a rocket to a moon and back if I'm not wrong. My question would be do you think a challenge ... Maybe not moon and back, right. MUSK: Yeah, not quite yet. Q: Space and back. MUSK: We're getting there. Q: My question to you would be do you think that incentives which is the biggest incentive to use, monetary incentives are the best possible incentives to get people to [18:00] participate and solve the world's biggest problems? Or do you think people can do it in order to just help everyone on the planet and make it better? Is money the only way to ask people to get in and solve challenges or do you have other ways to actually motivate people to participate?

MUSK: I think there's definitely a philanthropic element and I think in general, people want to do the right thing and they want to do what's good. The issue we have right now is that the rules fundamentally favor the bad outcome. When you're fighting for the good outcome and it's an uphill battle, it's just slower. **With respect to climate change, it's just critical that the government, and the government is the setter of rules. The governments decides what rules companies will play by and if we currently have a system which massively incents bad behavior.** Even if most people don't do the bad behavior, some people will still do the bad behavior.

Yeah, money and prices are basically just an information mechanism. They're just basically, they tell you that ... Money's mostly an information mechanism for labor allocation and tells companies what to do. It's just critical, this is why it's so critical that action be taken at a government level because the government is the one, they're setting the rules of the game. **It's just crazy to have the rules of the game favor a bad outcome.**

Staff: Question at the top there. There's a question here.

Q: Hi, Elon Musk. My name is Michel. I'm an undergrad in Economics here at Paris-Sorbonne, [inaudible] ... My question is there are some new studies on removing carbon dioxide from the atmosphere and burying deep [20:00] in the ocean. Do you think it's a sustainable solution and why? Thank you.

MUSK: **I'm not aware of any carbon sequestration or carbon storage system that works and works economically.** I definitely wouldn't want to store the carbon in the ocean because of possible acidification. As the CO₂ levels rise in the atmosphere, some of that is absorbed into the ocean, becomes carbonic acid. A lot of the shellfish in particular are super sensitive to changes in pH level. I would definitely err against [transfer 20:43] in the ocean. Though potentially, you could try to store some of it in giant underground

caverns, but the sheer quantity we're talking about, I don't think can be stored anywhere. There's just nowhere to store it, yeah.

Q: Hello, sir. I'm studying Management at [inaudible]. I would know how long do Tesla Motors intend to use lithium batteries knowing that it is not a limited resource?

MUSK: Actually, I think lithium in terms of energy storage, lithium I think is definitely the future and will be for a long time. There's actually not a shortage of lithium on earth. Lithium is number three on the periodic table. It's actually extremely common. Any salty water has lithium. There definitely won't be a lithium constraint on energy storage for batteries. I feel pretty confident that one could make enough batteries to store all the energy that the world needs with the current resources that are available, yeah.

Q: Hello. My name is [inaudible]. I am a PhD student in [22:00] Project and Infrastructure Finance in Sorbonne. First of all, I would like to thank you for your latest product, Powerwall, which to me it's gives to the citizens who have the power to select the way they can consume energy. I can spend few thousand dollars, buy some solar panel and the Powerwall and to be free of any offer in the market. My question is about the large scale storage systems you have designed. Have you received any serious involvement from governments and large companies to develop such infrastructure or do you have any serious plans within the United States or maybe in other countries ... ? MUSK: For large energy storage? Q: Yeah.

MUSK: Yeah, we do actually. We've got a number of very big storage projects underway with utilities around the world so both in the U.S. and outside. The thing that's interesting about the energy storage situation is that even without renewables, there's a huge potential to make the energy grid more efficient and to be able to shut down the heaviest polluting power plants because the energy consumption through the day usually changes by a factor of two or more and since ... With the exception of hydroelectric, you can't store the power, it has to be available in real time, the world has somewhere between two to three times as many power plants as it actually needs. If you can buffer the power with big stationary battery packs, then you can actually shut down the worst half of the power plants in the world. I think that's a very exciting thing that I think a lot of people don't appreciate and I think it's going to [24:00] make a big difference.

Q: Hi, sir. I'm [inaudible] from the masters degree, Innovation and Technology Management. My question is do you believe that in the ability of government, international government to prevent climate change? And what would you suggest?

MUSK: Yeah, absolutely. I think this fundamentally is a government issue so as mentioned, the government is the one that sets the rules of the game. They set how companies are rewarded financially. In the absence of government actually establishing some kind of a carbon tax or potentially a cap on trade on carbon, which I was very excited to see that China announced earlier this year that they were going to do that, unless the government does something to fix the market mechanism, we're fundamentally going to have a very slow transition out of the fossil fuel era. It's critical that government action change the incentive structure, yeah.

I'd be very clear. **I think hopefully what comes out of the climate talks in Paris is that the governments of the world, they have to put their foot down and they say five years from now let's say, there has to be a huge change and that companies know for sure that this is going to happen. If they do, then the investment decisions they make today will bear fruit in five years.**

For heavy industrial applications or for heavy industry, you know what the world's going to look like in five years if you know what factories are being built today. Because if you build a really big factory, to get to full production, takes about five years from the start. Since we know [26:00] that today, there are very few sustainable energy projects at large scale that are being built, we know that unless something changes very quickly, sustainable energy will still be in a bad situation five years from now.

There are companies like at Tesla and Solar City, we're quite ideologically motivated, but that's relatively unusual.

Q: Hi, Elon. My name is Thomas. What do you think about people who are saying that rather than trying to save the earth, we should try to colonize other planets?

MUSK: I think we should do both, yeah. Yeah, I think we ... My personal ideology is split right now between trying to be helpful on earth-related stuff, which is sustainable energy and then trying to advance space technology so we can establish a self-sustaining city on Mars. **I do think it's important to be multi-planet, not just one planet, but another planet. The overarching goal is to minimize existential risk.** If we look out into the future and say what are the things that pose a risk to humanity, what is going to make the future good versus bad, and I think obviously, if we have a sustainable energy future, that's good and the faster that comes, the better. And then if we're a multi-planet species, that gives us much more resilience against an extinction event and also would be a really great and fun adventure.

Q: Hi. My name is [inaudible], and I wanted to know in your opinion what would the future will look like in terms of energy sources and how soon could we use nuclear fusion [28:00] efficiently? Thank you.

MUSK: Sure. The thing to appreciate about the installed industrial base is that it's really enormous. The number of petrol and diesel cars in the road and trucks is about 2 billion. There are hundreds of thousands power plants using fossil fuels. Even if today, we went super hard in the direction of renewables, it would still take a long time. **I think before we see significant change, it's probably 10 or 20 years and there's a lot that can happen in 10 or 20 years of course. The faster we can bring that date forward, the better.**

Q: Yeah. Hi. My name is Natasha. I'm from the Masteral Program of Sustainability Development. I have two questions. First one, because I want to be optimistic that we're going to switch at some point to be completely sustainable and to use renewable energies, do you think that there are going to be a gap between developing and developed countries? When developing countries will be able to reach developed ones, switching into sustainable and renewable energies? MUSK: Sure.

Q: Second one would be sustainability of nuclear energy in your opinion? Thank you.

MUSK: Sure. Actually, I should answer the nuclear question because that was posed just before this. I actually think that nuclear fission, if it's in location that is not subject to natural disasters like in the case of France, there's a very high percentage of nuclear, I think that's actually a good thing. Obviously, you don't want to have nuclear fission power plants in places that are subject to natural disasters [30:00] because that obviously can go wrong. I think fission is a good approach.

Fusion is also interesting and it's exciting to see what's happening with ITER Project, which is a fusion plant that's being built in France. I do think fusion is a feasible technology. I think we can definitely make fusion work, but it is a far off technology. So to make fusion at the power plant level work is probably, I don't know, 30 years away and a lot of effort.

That's why at least for now and I think maybe even in the long-term, **I'm a proponent of using the big fusion power plant in the sky called the sun.** The sun is a giant fusion explosion and it shows up every day. If we have photovoltaics, solar panels, we can capture that fusion energy. It also needs to be stored in a battery so we can use it at night. Then we want to have high power lines to transfer solar energy from one place to another.

The important thing to appreciate is if let's say the only thing we had was solar energy, that that was the only power source, **if you just took a small section of Spain, you could power all of Europe. It's a very small amount of area that's actually needed to generate the electricity we need to power civilization or in the case of the U.S., a little corner of Nevada or Utah, power the entire United States.**

Q: Good evening. You do have a very impressive and stimulating career. You succeeded in business while staying true to yourself and beliefs. I would like to know what advice you would give to young entrepreneur [32:00] who is aware of climate change issues and maybe what was the best and the worst advice you were given about that? Thank you.

MUSK: I think if somebody wants to do something entrepreneurial in energy, either you want to start a company or you want to join a company that's doing something sustainable, and there's obviously wind, solar, and the geothermal. There's tidal power. **I would just say look at companies that are trying to do sustainable energy and decide if you want to join them or if you want to start one.**

Starting companies in either the automotive arena or the energy arena is quite a tricky business. When we first started Tesla and Solar City, we thought they would fail. Tesla in particular, we thought probably we've maybe 10% chance of success. Particularly cars, it's hard to stay alive as a car company honestly. [It must be 33:12] one of the worst risk adjusted returns, yeah.

Q: Hi. My name is Benjamin. I was wondering what do you wish for in terms of international rules and politics to facilitate implementation of your Powerwall battery?

MUSK: It's really what I've been saying here is that **the governments of the world need to price the externality. They need to put a proper price on carbon and then automatically, the right behavior will occur.** By putting a price on carbon, we're essentially fixing a pricing error in the market system. **Most of the times when [34:00] governments intervene in markets, it's usually increases the pricing error.** When a pricing error is a huge tragedy or a commons issue like we have with carbon capacity, it's critical that the government put a price on it because you just can't go wrong by ... **Any price you put on it will be more right than close to zero, which it is right now. This is by far the most important thing if we want to accelerate the transition to sustainable energy.**

There are other less effective ways, by providing incentives and subsidies to say electric cars or solar. That is sometimes a more politically expedient way to do it, but **the best way is just to directly fix the pricing error by taxing carbon. This is if you ask most economists, they would say the same thing.** This is well known obviously in the economics world.

Q: Elon, could you say a few words on artificial intelligence because I think I read or you were quoted among with others, Bill Gates and Peter Thiel and so forth, saying that you were afraid that one day a hyper intelligent machine would destroy humanity. Are you investing a lot into artificial intelligence because ... ? Are we wasting a lot of energy because we're using ... We're not being smart or we're not having smart objects and so forth? How do you reconcile the two if there's a long-term major risk?

MUSK: Yeah. I definitely want to stay on the sustainable energy topic because it's easier to get derailed on to many other things, but yeah, I just think we should be cautious about the advent of AI and a lot of the people that I know that are developing AI are too convinced that the only outcome is good [36:00] and we need to consider potentially less good outcomes, and to be careful and really to monitor what's happening and make sure the public is aware of what's happening.

Q: I'm Gabriel Rondon, I study Innovation here in Sorbonne. I have a question about fund raising, specifically about the fund raising process regarding what Tesla does. What is the most difficult thing to raise funds in the beginning, not now because now you have a well-developed project and worldwide knows you and knows Tesla also, but in the beginning about the industry that you are working, about this kind of energy, what is the most difficult thing to find investors and also to convince investors and keep what you thought in the beginning throughout the development of the company?

MUSK: Sure. In the beginning of Tesla and Solar City, I thought the probability of success was so low that I provided all of the money. All of the money just came from me personally. I didn't want to ask people, other investors for money if I thought we were going to die because I thought we were. I invested entirely the money that I got from PayPal, all of that got invested into Tesla, Solar City and SpaceX. Even then, we only narrowly survived so 2008 for Tesla, we actually closed the financing round on Christmas Eve 2008. It was the last hour of the last day that it was possible.

This is one of the tricky things with something like car companies. There are good times [38:00] and bad times, and when the economy goes south, then that's when things get really tricky for manufacturing company. Yeah. **In the U.S., for example, like the only two car companies that haven't gone bankrupt in history are Ford and Tesla**, that's it. Everybody else is bankrupt or went bankrupt at some point, General Motors, Chrysler, and others.

I think we just made it by the skin of our teeth. These days, the last few years, it's really I'd say the last two years is when Tesla's achieved a level where it's not facing imminent death. Even as recently as early 2013, we were operating with maybe one to two weeks of money.

Q: Hi. My name is Pascal. I would like to ask you, don't you think that we need deeper reflection about our dynamic of society? Because all the solutions that you are talking about is about efficiency, but don't you think that we need to think differently and consume less? Because right now, our dynamic is about confronting problems and going always in the same direction and trying to find the technological innovation to save us?

MUSK: Yeah. I do think we should watch our consumption. We shouldn't be wasteful, but even if we are really conservative in our use of energy and are very effective with recycling and all sorts of things, that delays the need to move to a sustainable future, but it doesn't eliminate it. If we don't have sustainable [40:00] energy generation, there's no way that we can conserve our way to a good future. We have to fundamentally make sustainable energy available.

On the plus side, there's actually an enormous amount of sustainable energy. The energy from the sun per square kilometer is a gigawatt. If you just had a one kilometer by one kilometer array of solar panels, it would be receiving a gigawatt of solar energy. Then at a 20% efficiency, you'd be generating 200 megawatts. We can actually generate way more energy, probably, I don't know, 100 times more energy than we actually need to operate civilization just with solar panels. **We just need to fix the incentive**

structure of the world to make sure that companies are incented towards sustainable versus unsustainable technology. This is fundamentally the problem.

Q: Hello. My name is Lily and I'm a PhD Physics student at Yale University, but I graduated here. I have three questions. The first one is sort of a political because you mentioned it. You said that scientists, sometimes they diverge. They have a different opinions and it's probably ... MUSK: Always. Q: Yes. MUSK: On anything. Q: Yeah. That's also probably because sometimes they are financed by different corporations. MUSK: Sure. Q: You said we should stop the propaganda. We should try to ask the politicians to set the rules so that we will go in a better direction, not global warming. That probably goes against the interest of oil companies, but as well probably the governments themselves when they have a financial interest. I was thinking perhaps your own [42:00] ... Perhaps, we could have lobbyists ourselves so that would be perhaps an efficient way to have those rules put into ... So these rules, the carbon tax would be applied. MUSK: Yeah. Q: That's my first question. Because also you know, France is one of the main importer of nuclear energy. MUSK: Right. Q: So trying to ask them for a carbon tax when themselves are the people who are making the most money from importing nuclear energy from power plants in France ... Staff: We'll limit it to one question per person for now. Yeah, thank you so much ... Q: The other question was renewable energy, that'd be great, but it's intermittent like solar energy. That's great, but perhaps, we need to store it with lithium batteries, but we want to use ... MUSK: Sure. Q: Yeah. I see. The last one was the fossils fuel area, yeah, is it not going to go to an end on its own because it's not an unlimited resource. MUSK: Right. Staff: Maybe pick one out of the three questions, Elon.

MUSK: Sure. Yeah. **I think each government, they should do the right thing without depending upon what other governments are doing. I think there's too much in these climate talks of countries trying to only do things if another country does it. If it's the right thing for the future, a country should just do it and don't worry about what other countries are doing. Just do the right thing.** Many of the [44:00] countries are. It's really just we just want to encourage as many governments as possible to change the rules to incent a good future. This is fundamentally what has to happen or we will substantially delay the transition away from carbon. Yeah. That's what has to happen.

Tesla and Solar City, my companies are very tiny. We're tiny, tiny companies. In order for there to be a big move towards sustainability, the giant companies have to know that that is what the governments are demanding for the future and that's what the people are demanding for the future. **At the end of the day, if the governments respond to popular pressure, like if you tell politicians that your vote depends on them doing the right thing with climate change, that makes a difference.**

If they're having a fund raising event or a dinner party or whatever, and at every fund raising event, in every dinner party, somebody's asking them, "Hey, what are you doing about the climate?" Then they will take action. **I think you have tremendous power. You have the power to make a change.** Let me tell you. We definitely can't beat the oil and gas industry on lobbyists. That would be a losing battle. Exxon makes more profit in a year than the value of the entire solar industry in the United States. If you take every solar company in the United States, it's less than Exxon's profit in one year. **There's no way you can win on money.** That's impossible.

Q: Good evening, sir. I have just one small question. Actually, do you think the COP 21 will be a success?

MUSK: I don't have any real [46:00] basis for this, but I have a good feeling about it. I do have a good feeling about it. I think it's going to be degrees of success. Like, for example, the Copenhagen was terrible. Nothing came out of Copenhagen Climate Talks. It was basically I think there was a net increase in global warning as a result of that one unfortunately. In the case of the Paris talks, I think there will be some

positive movement and it's a question of what degree. **I think we need to send a clear message to the negotiating teams and to the politicians that this time, there needs to be a significant change.** This time, something needs to happen.

Staff: There's a question all the way up at the top ...

Q: Hello, and thank you for coming. My name is Maria and I'm a student of International Relations here. My question to you is this, we know that climate is a global common good. How do we get countries with economies relying heavily on fossil fuels on board with climate change, like how do we get those who have the most to lose on board? Thank you.

MUSK: I think we just need to turn that argument around and say, "Look, this is a common good and if countries don't take action, they all will share in a bad future." Everyone needs to take action and care about what the future's going to hold and lead by example. Even countries that are quite dependent on fossil fuels, if they just change their tax structure, they can move away from that in a way that's not super disruptive to the economy.

It's really just a question of collecting the same amount of taxes, but weighted towards [48:00] things that people believe are most likely to be bad instead of things that are most likely to be good. We do this already in our tax code. **We tax alcohol and cigarettes much more than we tax fruits and vegetables.** It's just the sensible thing to do. You don't hear countries saying, "We make lots of fruit and vegetables. We want low taxes. We make lots of alcohol and tobacco and we want lower taxes." That's a silly debate. It's gone.

I think the same thing applies to carbon emissions. **Just adjust the tax code and the right thing will happen over time. If it's graduated over time and it starts off small and becomes significant in the future, then even if you're heavily dependent on carbon today, that message of seeing what's going to happen in the future will have a huge impact on the way that any given country's economy works.** They will then become not dependent on carbon because of the incentive structure. I really don't think they have anything to lose here, anything to lose by taking action and a lot to lose by not taking action.

Q: We have time for maybe two or three more questions. There's one right here.

Q: Hi. My question is about batteries. Electric batteries today, especially lithium ion have a significant carbon footprint and potential impact on both the environment and our health. The environmental impact moves away from consumables and to how we produce and how we store the waste that comes from it. The gap with fossil fuels might not be as wide as we think. My question is how do you respond to this? How do you see this evolving in the next years? MUSK: I'm not sure I totally understand that question. Could you say that again, yeah? Q: Basically [50:00], the impact on the environment of today, our [waste 50:04] of electrical batteries, lithium ion, the production of lithium ion batteries. MUSK: Yeah, sure. Q: How do you equate this with fossil fuel and its impact as it's more about the production and how we use the waste and how we store the waste? How do you see this, how is this going to be optimized in the next years or is this going to change?

MUSK: Yeah. The one thing is once you've built the battery, then at the end of life of the battery, you can recycle those components. It's something that has no long-term or negligible long-term impact on the carbon cycle because you essentially, you get the lithium, and nickel, cobalt, and you create the battery. Essentially, you get those materials once, and then you recycle them forever. I think it's really a negligible impact for batteries on the environment. Yeah.

As compared to carbon producing, mining and burning billions of tons of carbon every year, which effectively permanently from a human standpoint affects the carbon content of the oceans and atmosphere. Yeah. It's really we're talking orders of magnitude of difference between fossil fuels and batteries, not even on the same scale.

Staff: The last one.

Q: Hello. My question is taking into consideration the technology now is at a [somewhat of a 51:46] breaking point, it is advanced, but not so advanced to pass to the sustainable clean energy. How do you see this integration of clean energy for the long term in the future? Step by step [52:00] maybe? MUSK: How do I see the integration? How do I see us getting to a sustainable energy future? Q: Yes, yes. How will the clean energy integrate into the society taking into consideration that technology isn't advanced?

MUSK: Sure. **I expect all transport to go fully electric over time with the ironic exception of rockets.** Then all energy production to go sustainable over time. This will take a long time, many decades, but the way it'll manifest itself is by people having batteries in their homes or at the utility substation and by driving electric vehicles and having electric planes. As I said, this is going to be a very slow transition because the incentive structure is so biased against sustainable energy.

In fact, I think even if there's quite a strong action by government as a result of the climate talks in Paris, I think it's still going to be a transition that's measured in decades. It'll be a slow transition and the fundamental question is how do we accelerate that transition? That's the real question here. **What actions can we take that would accelerate a transition to a good future? That's why I'm so harping on this notion of a revenue neutral carbon tax. I think that's something that every country can implement and it could be graduated and phased in over time. This will be by far the most effective thing for accelerating that transition to a good future.** Yeah.

Staff: Thank you.

MUSK: All [54:00] right. Thank you everyone. All right. Bye.

Unverified translation from stream at <https://www.youtube.com/watch?v=iavquu6PP9g>

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