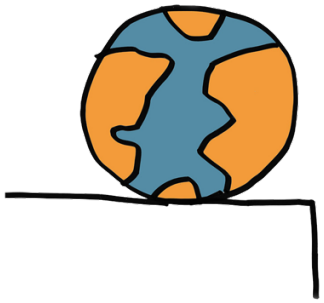
SEIZING AN ALTERNATIVE

Toward an Ecological Civilization

June 4-7, 2015

Section I: The Threatening Catastrophe: Responding Now



Transcription of Robert Haw's Presentation on Carbon Fee and Dividend to Track 1

(Recording missed first 3 charts and first bullet of 4th chart. Time indication following slide numbers are time stamps at start of segment.)

(Slide 4) They all start from first principals, so they almost all start from previous modelers. Now, I'll talk about the government's estimate of this carbon pricing, they call the social cost of carbon. It's your government that's come up with this cost. And then I'll talk about carbon fee and dividend. which the [Citizens's] Climate Lobby is proposing to solve the carbon emissions problem.

(Slide 5) [00:37] Setting a carbon price representative of the real environmental cost is the challenge. Some people also want us to maintain growth at the same time. So, how do we set the carbon price?

(Slide 6) [00:56] Let's find what the value in the natural world really is. Can we make an assessment of what the value really is out there. When we do that, in my humble opinion, we should follow this principal, usufruct, an old word, a favorite of Thomas Jefferson. It means, it's okay to use stuff, but we shouldn't use stuff up. Like, if you find a campsite, you should leave it in better shape when you leave it than it was in when you found it. So, that's one way to frame this, to put a value on it. Now, there are many different opinions on how that value should be set. The market place puts a great deal of value on the profit motive. The government's view places a strong emphasis on business-as-usual attitudes. And then, the rest of the world. You can lump them all together for now. They want to "free-ride" on this. They don't really want to see rising seas on their beaches, but they don't want to pay for the mitigation either. So that is a big problem for any country that takes the first or second step in this regard.

(Slide 7) [02:19] So, what are ecosystem services? This is where we start from first principals. The reliance on the natural world for our goods and services. Fishers, loggers, farmers. All those people are using the natural world for income. There are some estimates, and there are very few of them. Now, there is an estimate of $125 trillion per year is what the natural world provides. That comes from a paper first written in 1997, updated in 2011. This number, I'll show you in the next slide how it comes about, but it isn't looking at the price of something. This price is outside of the market system, it isn't privatization. But, I don't know what you could say is the value that is lost per year. I think that is an unknown value right now. This needs to be known. So, we know a rough estimate of the total value, but how much of that is being lost each year? It is probably in the trillions, but we don't know. And, this comparison, here's the global GDP with $75 trillion, and the US with $15 trillion. That's in 2011, they're both much higher now.

Question: We're extracting $125 Trillion to produce $75 T? How do those numbers relate to each other?

Answer: Let me show you this next table first.

(Slide 8) [03:52] So, this is a table from that report I mentioned. So this is the value that has been estimated of the services that have been provided to us throughout the world, now I will

tell you what I mean by that. This table is kind of busy, but let's look across the top. This is talking about gas regulation. water regulation, water supply, erosion control, soil formation, nutrient site preparation. All of these services are fundamental, they are needed to perpetuate nature from year to year. Okay, you can go along, and there's a lot more. And then you look at different geographical areas throughout the world. Then ocean, coastal areas, then break coastal into subsets. Forests, tropical and temperate. The authors of the paper were ecologists. They tried to come up with an estimate. The estimate they came up with back in 1997 was $33 trillion. That has now been updated to $125 trillion in 2011. So, no doubt there are errors, maybe categories that are missing, This is what I think we need to go for. If we don't have an assessment like this, of the values, and how the base has been lost in value, in order to get a true value of what nature is providing. So, we don't have any value of a loss.

(Slide 9) (06:04) So, the best I could come up with at the time, to give us a ballpark starting figure, was an IMF estimate that just came out this year. Bill [McKibben] mentioned this a couple nights ago, this $5.3 trillion per year. What this is, I'm just trying to approximate the ecosystem system yearly loss from known fossil-fuel burdens on society. What that includes, this burden is very very conservative, very limited in its scope. it's fuel subsidies around the world, local air pollution, global warming, the effects there of. I mentioned a few slides ago the U.S. government's view of carbon pricing, and they had this social cost of carbon they came up with. So, spoiler alert, it's a low number. This global warming is computed by a number giving the number of tons of carbon dioxide emitted here, then multiplying by the U.S. social cost of carbon number. That contributes in here, but does not contribute very much. Just to give you an idea of what the value is, you take these emission burdens ($5.3 trillion), you divide it by this number (33 billion) and here you come to a number you will see a few more times in this presentation ($150 / tCO2). So, we are talking about $150 per ton of CO2 released. That is a number, right now, very very conservative on what the price of carbon is today. But, it gives us a ballpark of what to think about.

(Slide 10) (08:06) So, what are the externality costs that that represents? The $150 represents the damages caused by carbon emissions. And that's what an externality cost is. It is the cost of inaction. These are future costs that are not currently being accounted for. Say, you have a hundred thousand dollar house. If you know for sure it's going to be washed off the shore, say it is river-front property. If you knew you were going to loose it, you would want to start taking account for that now. Well, economists have ways of doing this.You're all probably familiar with that, but that's future costs. So, the U.S. government has come up with a social cost of carbon, and that now, whatever the number is, brings climate change within the purview of economics and policy decision makers. So here is a definition, and this is important for later on, I mentioned the future damages associated with the incremental increase in carbon emissions. How much damage is that going to over the next, say, hundred years? But here, this is the government's definition, "Losses are to include (but not limited to): agriculture productivity, human health, flooding, and ecosystem services." So, what's the price? Before we talk about what's the price, we have to talk about how to figure out the price. And so, economists have built integrated assessment models in order to connect the science to economic impacts.

(Slide 11) (10:18) These traditional integrated assessment models include, when they're trying to account for climate change, they will compute economic loss as a function of $\triangle T$, that's jargon for change in temperature. So, you hear talk about, we're now at 0.8 deg. warming, that's from the pre-industrial era. We're going to go another degree or so. That's what this delta $\triangle T$ is, a temperature increase. So, this model, then, this computer program accounts for these really easy to quantify impacts such as lost agricultural output. It's like the tomatoes spoil earlier so

there is crop loss, or higher air conditioning costs, or lower worker productivity. That's good, I'm glad they include those, but what they don't include: catastrophic loss (nothing), disruptive feedbacks on economy (nothing), such as sea-level rise, loss of farmland due to flooding and droughts, (now, that's different from loss of agricultural output. The same farmland is still there. although it's hotter, this is actually loosing land, like it being swept away. Wild fires, these kinds of things. And then, they also don't include this total-factor-of-productivity. You here congress talking about efficiencies, innovations, it's just that. We don't need to go into that.

(Slide 12) (12:07) Also, specifically excluded from IAMs are rising costs of healthcare, natural-capital destruction, and ecosystem services. Now, the reason they are not included is because they are "speculative and uncertain." But, you remember a couple of slides ago, the definition of social cost of carbon was to include these very services. But, they're not. So, the bottom line here, the presumed economic growth (and it is presumed, that's what economists live for) is weakly coupled to damages and climate / ecosystem feedback. So, basically, SCC is "insulated" from climate disruption. So, we'll play this little game, but that isn't really part of the real answer we've been given.

(Slide 13) (13:10) When the U.S. Gov't first wanted to come up with the social cost of carbon five - six years ago, they turned to business-as-usual economists for advice. They did not talk to ecological economists or ecologists such as those who wrote that paper from that earlier slide. Now, a major problem with regular economists is their devotion to business-as-usual. So, they are omitting crucial, "unfamiliar" parameters, they're not keeping up with the current science, And, the model lacks an empirical basis. They're kind of pulling something out of the air and saying, oh well, that's kind of good enough. So, for an example on that, the damage model, the premier IAM (we heard of that from David, the Nordhaus model.) His model assumes damages are proportional to 0.4% loss in GDP for every degree F rise, which means, half the world's economic output still remains after a 34 F rise. Remember, most of the world is water, so over land, that 34 would be more like 100. That's what I mean by lacking an empirical basis. It's not founded in actual data.

(Slide 14) (15:10) One thing important to the social cost of carbon is the discount rate. The present value of future costs and damages.

(Slide 15) So, the discount rate is usually set equal to the prevailing bank interest rate, because it's easy, or something the Treasury knows. or easy to find a number for. So, you all know what an interest rate is, and it's not the same thing as a discount rate. Discount rates are much more sweeping, because, decisions now can affect entire societies over many generations. You set a discount rate, and the money that flows into that process will set up the dominoes that will be falling for a long time after. So, the discount rate really needs different criteria than the daily bank interest rate.

(Slide 16) (16:30) And this is why the discount rate matters. If there isn't a discount rate, or it's at zero percent, then the present and future damages are treated equally. That $100K house would have to be put on the ledger as a $100K loss. If the discount rate is greater than zero, then the present value of those future damages are scaled down, or discounted. So if the discount rate is highish in the context of climate change, then we aren't too concerned about it. Because, those costs can be borne by future generations. But if the rate is lowish, then it sends a very different message. The costs are really high right now, and so the natural response there is to do something.

(Slide 17) (17:26) So, a graph to show the sensitivity to the discount rate. So, let's say we want to stay below 2 deg C rise, and there's a probability associated with it. Let's say there's a 66% chance of keeping below 2 deg C. Let's say we take a 1% discount rate, we go out along this, we call a log (or logarithmic) scale, shows it would be $250 per ton of of CO2. Everything else stays the same, all that changes is the discount rate. If we take 5%, it's like $30. So, it's $30 if you choose 5%, but $250 if you choose 1%. So, it makes a big difference.

(Slide 18) (18:45) And this is what your government has decided as the social cost of carbon. As of this year, 2015, it's this column here, the 3% discount rate. So, right now, in 2015, the social cost of carbon is $39. If it was implemented, that $5.3 trillion that I said included the social cost of carbon, they used this number. So, these numbers slowly grow over time, not very fast. Now, you can see over on the right another category which wasn't selected. You probably remember what 95% percentile means. Those are the guys that got on the basketball team in high school. Those were the guys, height wise, were in the 95% percentile. Well, if that's the case, you are far out on the edge. But average, what does average mean? It's purposely ambiguous, or not clear. Average means 50%. So, the government is saying, we're giving you a 50% chance that what the price we are telling you is right. Or, the 50% percentile at 3% discount, gives $39.

(Slide 19) (20:37) This comes from the Carbon Tax Center. I rounded the $39 up to $40. Starting with $40 per ton the first year, and increased this at 5% per year. Many economists have said that can be accommodated with no problem. That would give us a 20% drop in CO2 emissions after 10 years. Remember, this is $62, we're kind of looking at $150 as a comparison.

(Slide 20) (21:14) So, now lets make some other comparisons, between Nordhaus and Stern. So, Nordhaus is the author of the DICE model. This model is the major contributor to the Social Cost of Carbon. He's this guy from Yale we heard about earlier on. What's sort of the prime directive in the DICE model, when he wrote this program, he wanted to maximize human welfare within the model constraints of carbon pricing. His metric for well-being, is consumption. Gross Domestic Product. He wants to maximize consumption in order to maximize human welfare. One way to do that, and another way on top of that, is to set the discount rate high. Because, by setting it high, it increase current prosperity. Because you don't have to pay $100K for that house, maybe you only have to pay $50K now, so it increases the current prosperity. And, he has this silly damage function that I mentioned: 0.4% global GDP for every deg F. So, what that works out to with current warming models, is, by the year 2050, around 1 1/2 percent loss to GDP will be lost each year.. Now, compare that to Stern who is in the U.K., who uses a different damage model with a low discount rate, and he's saying the annual losses will be, on the low end, 5%. So, 1 1/2 vs. 5, or maybe much much higher.

(Slide 21) (22:57) So, what does that translate into money wise? So, using their respective discount rates, Nordhaus comes up with $33 per ton. A little bit less than the $39 of the government, Nordhaus was the primary contributor to that cost model, but there were a couple other contributors to it too. Stern, on the other hand, guessed $90 per ton of CO2 right now, and he's using a 1.4% discount rate.

(Slide 22) (23:35) Now, which of these models better represents reality? It's been over 20 years since climate change has been in the news. There should be enough data now to discriminate between these two models. We need observations and we don't have them. We don't have them in the sense of that table, remember that table I showed you? All those different categories. That data needs to be collected. We have some information, we have insured losses. Insured losses from these re-insurance companies were half a trillion dollars in both

2011 and 2012. But, we need to validate past predictions of the data. Economists are great at making predictions. First they say, this is going to happen, then the governments make a decision, and this is what we go and do. No one ever revisits that, to see if that decision bares up to what's going on. So, we need to validate these models. So, I wanted to validate it in some way.

(Slide 23) (24:24) So, what I did, It's a very indirect validation, but there's a very good paper. I call this the second "gold standard," the Costanza paper, the one I showed with that big table. (Ecosystem Services). There's this one by Epstein called "The Full Cost Accounting for the life cycle of coal," written in 2011. They have a very rigorous analysis of what coal is costing right now. It's market price on average of $50 / ton, that compared with SCC of $14 / ton of CO2 emitted Mostly health costs, and related in that respect . And some current damages due to burning coal. They have an estimate of $287 per ton.

(Slide 24) So let's use coal as a proxy for all fossil fuel externalities. Okay, now, that's a high-end approximation, and using a 1.5% discount rate, Right now, in 2015, the price should be $305. Using the best data we can, which is Epstein. So, it's getting higher. Just this footnote, Epstein's costs are closer to Stern than they are to Nordhaus.

(Slide 25) This is a selection of different social costs of carbon in the year 2050. I'm not going to go thru and explain all these. These are different models, different authors who have come up with these costs. They have different damage functions, meaning 3 or 4 deg. rise, but this one on the left is our favorite here, Nordhaus. And here it is, in 2050, using his favorite 3% discount rate, is $64 social cost per ton of CO2. And, of course, if you take different discount rates, 1.5%, the blue circle, is up higher. But, all of his are lower than all these other models.

(Slide 26) (28:30) So, here are some predicted carbon prices. These on the top are existing in the market place right now. Regional Greenhouse Gas Initiative which is in the North East (New England area), they have it at $5 per ton. In Europe, at 8$ per ton equivalent. The novelty there is they sell permits, action them off. Similarly, in California, they are auctioning off CO2 permits at a little over $12. British Columbia has a price of $27. Nordhaus, we've seen this. U.S. Gov't at $39, Stern at $90. The U.S. Gov, if it just used 1.5% discount rate, it would be at $128. Here is Croady (which is the IMF). These are good studies here (Ackerman, Moore) with Epstein even higher than. There's a progression here, getting higher.

Question: Is there a discount rate associated with the existing?

Answer: No, discount only pertains to when you're looking ahead.

Question: Are you saying the costs now are much lower than for the future?

Answer: Yes, not even close.

(Slide 27) (31:11) So, price has to go up to keep fossil fuels in the ground. It's way too low right now. So now I'm going to shift gears.

(Slide 28) Now will talk about how to keep fossil fuels in the ground. If we implement a simple plan commensurate with the social cost of carbon.

(Slide 29) So, this is what we would like to see in a CO2 reduction plan. Have a plan the encompasses all carbon emitters. Everybody on board, no free riders. It must be effective, fair, and it has to act fast. Remember that carbon countdown clock.

(Slide 30) (32:00) So, here's one example, you've heard about this in the news. The EPA's Clean Power Plan. Reduce emissions by 30% by 2030. It's a good star, but not nearly enough. But the bigger point, it's not inclusive. It doesn't involve everybody.

(Slide 31) So, let's do it another way. Let's use marketplace methods. Let's play to our strengths, the strengths of the marketplace. Let's invoke the economy as an engine to achieve these climate goals. And so, it's really a simple idea, and I think you all understand this. We just need to price carbon so that we can draw out all those hidden costs that currently are not being accounted for in the marketplace. Setting a price on carbon will essentially make the market tell the truth. And here are three ways to make the market tell the truth: Cap and Trade, Tax and Spend, or Fee and Dividend.

(Slide 32) There are a lot of words on here, and I don't want to go thru them all. Cap and Trade, it's a possible plan. It says, carbon emissions are limited by gov't regulation, Regulatory agencies issue CO2 permits, those permits are then tradable and thus acquire value. There's a lot of problems, and rather than go thru all of these one by one, let me just summarize and say, Cap and Trade is bureaucratic, is expensive because it is bureaucratic, and it doesn't get all the CO2 in the economy. It leaks. And, it's also hard to prevent free riders internationally with this plan.

(Slide 33) (34:10) Just to give a picture-graph of it, cap and trade will work well when emissions are variable. The cap is level, like this, emissions are local, and damages are clearly defined. So, acid rain problem is sort of the ideal poster child example. With a cap, you can keep everything beneath that level. With a tax, the output varies a little, it averages about this. In this case, the cost to society was minimal. It was worth the payoff, there is no more acidity over the lakes and streams.

(Slide 34) Now, on the other hand, the Carbon Tax, the emissions variability here is small compared to the ultimate goal, down here. The carbon tax is simpler, equally effective as Cap and Trade, and much less costly. It's a little bit rough, but it really doesn't matter. These little giggles up her are really insignificant in comparison to the ultimate goal.

(Slide 35) So, there are many advantages to the carbon tax, but unfortunately, whenever anyone hears about a carbon tax, what's the first thing they talk about? The disadvantages. It reduces economic output, slows growth, and it adds a burden to all of us, the taxpayers. So, that works, and yet, hurts the tax payer.

(Slide 36) (35:46) Here's a third strategy, a revenue neutral carbon fee. The advantages to this are the same as the carbon tax, although I kind of skipped over them. But in addition, this carbon fee doesn't place any burden on tax payers, grows the economy, and creates jobs. So, it has a lot going for it.

(Slide 37) (36:25) I'd like to talk about a specific version of it called Carbon Fee and Dividend. And here's a slogan that just might work, "Here's your check" to entice people to listen up.

(Slide 38) Here's the densest part of my presentation. I have four slides like this, but this is really describing what this is all about. The idea is the federal government will collect a pollution fee on companies extracting fossil fuels. That's it, just a few hundred companies. When that pollution fee (it's called a fee because it ultimately will be returned to the people.) So, the fee will be applied at the source, where it is extracted, or where it crosses borders, port of entry. It's much easier that way because there are far fewer sources. The fee will be proportional to the carbon dioxide content, so coal is twice as dirty as natural gas, so the coal fee would be twice as high as natural gas fee, but in either case, the fee would start off really low so as not to cause a hardship on any individual or any business. Then it would grow steadily over time so people and businesses could accommodate to it. Just like the little diagram shows. Then, year after year, there's a fixed price increase. At least, this is plan that CCL advocates and it's rock solid, at least in my view. Renewables would not be assessed this fee because they don't have any heat-trapping gasses, so that levels the playing field.

Question: Does that leave subsidies in place?

Answer: This isn't talking about removing subsidies. CCL is all in favor of removing subsidies, they should be removed, but this doesn't address that. You can leave them in place, but this will be even more effective if you take them off.

Question: What about the emissions necessary to make those entities that allow you to have, like, solar power?

Answer: Yes, but there would a race to the bottom (or top). The first company that could make solar panels using solar power, they would be able to get a head start in the marketplace.

Question followup: Now, I meant silicon-based solar panels. Their industry is very polluting to create those panels. There is CO2 produced in the making of these panels.

Answer: If you get an industry making solar panels that is powered by solar energy, it's a bootstrap process, for sure. We're in a fossil fuel economy now. We're trying to extract ourselves from it. We have these industries in place, and we hope to get more renewable industries. It wouldn't go on forever. Admittedly, it will be a long time in coming, but it won't come if we don't provide some form of motivation.

(Slide 39) (38:52) This is about the dividend that gets collected from these companies. It gets deposited into a trust fund, and then 100% of the proceeds are returned to us. In actual practice, it wouldn't be 100%. It would be 100 less the administrative costs. Estimates have been made in what that would be. In the first year, it could start at 3%, based on George W. Bush some years ago when he sent rebate checks out for a couple of years. To do his, the first year was 2.5%, but the next year was about a quarter of a percent, so it would be like 99.75% that was returned to people. There would be equal-sized rebate checks sent to all households. No means testing. Everybody gets the same size of check. In the 10th year of this particular program, $3600 per household would be returned. So, that's no strings attached. What ever you want to call it, a green check or dividend, this comes back. Doesn't matter what kind of car you're driving. You have the choice, you can decarbonize your life style, and in that case, that rebate check that comes back is all yours to do what you want with, or, if you are one of those driving a Hummer, you might spend almost all of this just filling up.

(Slide 40) (44:06) The fee will incentivize all players in the economy. It will motivate the switch to energy-efficient cars and appliances. And it will really motivate new entrepreneurs to come up with new business plans.

(Slide 41) And it will work internationally too. if the trading partner does not have a carbon fee, and this part is really important, then you apply a border-tax adjustment, a BTA. Ao imports would be assessed a tariff because they generated/manufactured something cheeper because they were using un-carbon-taxed fuel. That is a tariff on that product as it comes across the border to make it equal as a product to what we make here. And exports from our country into theirs would be subsidized for the same reason. And then, these border adjustments will discourage those “free rider” nations. There would be a big motivation, in fact it’s happening right now. Every COP meeting, everyone is pointing fingers at each other and saying, “you first.” That’s fine. If a nation doesn’t want to implement a carbon tax or fee, that’s okay. But, they would not be part of the club. If they want to sell into the club, they’re going to have to pay this boarder tax adjustment. We say, join the club and assess a fee, then you will no longer have to pay this border fee.

Question: In setting the tariff on imports, do we have to analyze every product for its carbon content?

Answer: It’s a difficult problem. That would be a problem that would have to be worked out in more detail. This is kind of sausage making. Some nasty decisions still. But this can still serve most of the purpose. If it doesn’t work when first implemented, it can be revisited and change it. I don’t have the exact answer for that question, but it is a point that is well taken.

Question: And for exports?

Answer: Will, I think exports would be a lot easier. We would have better control over products that are exported. There would still be some analysis involved.

(Slide 42) (47:04) There are some real examples. The Province of British Columbia in Canada, they implemented a revenue-neutral carbon tax in 2008. They started it at $10 per ton, increased in every year by $5 per ton for five years. They went up, and now they are just holding steady, letting the rest of the world catch up to them. But, as of 2013, fuel consumption per person was down 19%, total CO2 emissions were down 10%, and their economy was performing better than the rest of Canada. Whereas, before this program began, they were in a bit of a slump. This was a successful implementation. Even the World Bank applauded this program.

Question: Was this fee and dividend?

Answer: No. A revenue-neutral carbon tax. The way they implemented it was they adjusted tax rates, income and corporate tax rates, they lowered those. But, the money that was saved on that was returned to households. The money is returned one way or the other, in this case, thru marginal tax rates.

(Slide 43) Using this model, there was 12% drop after 5 years using that model. It’s actually says (in Slide 42) 10%, this says 12%. This is not a perfect plan. Their plan only applies to 70% of the economy. So, if you take that 70% of this, it is almost exactly the 10%, so the model works.

(Slide 44) (49:20) And then there's a more sophisticated model published last year by a pair of companies, REMI and Synapse. This was a revenue neutral carbon tax. In their study, the fee started at $10 per ton and goes up $10 each year.

(Slide 45) This is what they see from their very sophisticated model. Employment goes up. This is 2 million jobs after 10 years and it keeps going up after that.

(Slide 46) Lives are saved because of cleaner air. 13,000 lives in the 10th year. These different colors are different geographical areas.

(Slide 47) Here's the monthly dividend. We talked about that fee starting low and going up. Well, this is what happens with the dividend. It starts low, and rises. After 10 years, $300 per month. There are costs involved. After 10 years, the price of gasoline would have gone up $1 per gallon. So, you'd be paying that additional amount for gas, but you'd be getting that $300 per month in dividend back.

(Slide 48) If you made no changes in your lifestyle whatsoever, this is the real income, the net impact of changing wages, prices, and the dividend, how it all works out. It would still be a net positive benefit. This is a reduction, it's not $300. It would be $500 per person per year. But again, no changes. If you did make changes in your life style, then you would still get those dividends back.

(Slide 49) And, of course, there is a big drop in heat-trapping gases. 33% after 10 years, 52% reduction after 20 years.

(Slide 50) So, just looking locally, in the San Gabriel Valley. In the first year of the program, $10 per ton, what would it cost people that first year. "Energy intensive" goods up $25 / year / person. Gas prices in the first year would go up 8 cents per gallon, which would be about $35/ year per car. And electricity in Pasadena, would go up half a cent because of the renewable portfolio standard, and that would be around $30 per year. You'd have these costs, but the net rebate to a family of 4 would be $550 in the first year. Right in the first year you're making positive. You're getting a net benefit.

(Slide 51) Now, I'm not going to be going through all of this. It's really kind of a business slide. But, the key point here is that all of these are positive points.

(Slide 52) In summary, this particular implementation works. It's all encompassing, it's effective, fair and fast. We have some examples. It works. Carbon Fee and Dividend is a great way to get the decarbonization ball rolling. That's the good news story.

(Slide 53) But unfortunately, it doesn't work fast enough. Not, if we're going to take into account the carbon countdown clock. You can see how this is bottoming out here. We can go out a little further and it gets down a little bit lower, but not a lot lower. This is 20 years. We only have 20 years in that count-down clock, let's say 30 years and be generous. So, by the time we get here [at 2035], there's only been a 25% reduction overall (accumulatively). Well, there's been a 50% reduction in CO2 emissions, In other words, we're talking about the carbon budget. Devon mentioned we have a half a trillion left. There was a trillion tons from 2000 to 2050. So, as of 2015, we've used up 500 of that. The next 20 or 30 years, we have 500 left. Unfortunately, this here, this 52% reduction, if the whole world started the same day the U.S. does, and follows this

same plan, and follows this same reduction, and we apply it to the whole world, we use up the 500 there [points to something short of 2035.] This is a problem.

(Slide 54) (54:50) Let's compare that pricing I gave you, which was the CCL "party line." $10 per ton, because it's easy to accommodate. It doesn't cause hardships to people. Let's use the Epstein price, increasing to $400 per ton by 2035. The levelized fee is $20. Well, that only gets us to 60%. It was previously 52% after 20 years. Well, we have to get down close to zero, okay. Let's try higher. Let's go to $35 per ton. That gets us a little more reduction, 66% after 20 years. Or after 35 years, we get to 70%.

(Slide 55) This, $5000 per ton, is where we need to go. If I apply that carbon tax model, and I start it in year zero, The social cost of carbon in the U.S. is $40. You saw that one plan, I started at $40 and went up 5% the first year, got to 20% after 10 years. If we start with $40 with a 25% increase, that's what is necessary to reach this price ($5000 per ton) in 30 years. That's the kind of range we're talking about. It doesn't seem very practical. Although, there are lots of other programs that can help. But just looking at this strictly numerically, existing models, that will give all of us in 5 years. You start at $40. A quarter of $40 is $10 increase the next year. So, $10 was what we were talking about in the CCL plan. Second year would increase $12.50. You would have 4 or 5 years when you can fit that in my budget. But very quickly, it's going to go astronomical. But that last 30% of the cost of fuels is going to be so inconvenient, and so valuable to whoever is using it, they're going to take an exponential increase to drive that to zero. So, this is the problem that we face.

(Slide 56) Here is my last slide. "Economism" is the planet's biggest religion, so we should try to play to its strengths. Short term, CFAD is an effective fix within the market system, because we know it works. But, over the long term, economism is not in the biosphere's best interest. Carbon fee and dividend is simple and fair. It does a very good job of eliminating the 'free ridership' problem. By eliminating the 'free ridership' problem, we encourage other nations to join us from all around the world. But, "reasonable" fee increases over a 30-year span will not achieve even a 90% de-carbonization. The rate has to be near-exponential. Carbon fee and dividend is necessary, but it is not sufficient.