RICHARD SCHMALENSEE: Let's march ahead into upstate New York and do formaldehyde. But first, there's a what should business do issue that I should have brought up last time. So I'll bring it up now, because I didn't. This is super PACs. How many people know what the *Citizens United* decision is or was?

AUDIENCE: [INAUDIBLE]

RICHARD SCHMALENSEE: So well, it's more than that. Yes, a few. Let me just walk through a little bit. So before 2010, basically, corporations and unions-- well, they still can't make direct contributions to candidates, they could fund independent organizations that put up political ads. But the political ads couldn't be near elections, et cetera, et cetera.

Now, after this decision they can do essentially anything, as long as it's not formally part of a campaign. So if you've been following this year's Republican primary season, there are a lot of super PAC ads targeting one candidate or another. Most of it's negative, and there's a lot of money.

The question is, you're the head of a publicly traded corporation. You can now make major political contributions. The corporation can now make major political contributions.

Should you? Should you, or when should you? Stephen, what do you think.

AUDIENCE: I think they should be able to.

RICHARD SCHMALENSEE: They're able to. I'm not talking about that. Should they?

AUDIENCE: [INAUDIBLE]

RICHARD SCHMALENSEE: You're the CEO of-- oh, pick your favorite. You're the CEO of Apple. Should you-- and Apple's got a lot of cash. Should you spend some of it to give some of it to a super PAC which has a political agenda that you know? That's all.

AUDIENCE: At the end of the day, I think there is no harm in doing so, because I would recommend or I would eventually do that, just because when we have all these different candidates that could potentially move things in a different direction-- especially for a company like Apple that relies heavily on foreign countries to do some of their manufacturing, or some of their new products coming out in other related patents, it could be very favorable for them see a certain type of political candidate in office rather than someone else.

RICHARD SCHMALENSEE: So you would do it where the corporation's interests were likely to be directly affected. Any other reason you might do it?

AUDIENCE: I would also do it-- as could also do it as more of a publicity type of thing, where [INAUDIBLE] [? saying ?] we're in favor of this green energy Initiative. And we would like to see our candidates support it in that area.

RICHARD SCHMALENSEE: OK, David, you with him?

AUDIENCE: Yeah, I agree that-- I mean the [INAUDIBLE] as a CEO, I would probably donate some money if there was a direct impact. But also, again, for PR, [INAUDIBLE] accomplish [? as far as the ?] company in general, I think Apple gave money to a political action candidate opposing the gay marriage [? act ?] in California. So that's [INAUDIBLE] part of [? the ?] initiative [INAUDIBLE] push forward.

RICHARD SCHMALENSEE: I think that might have been Apple's regular PAC. I don't think it was a super-- maybe I'm wrong. I think the regular-- the regular PACs, let me describe it. They've existed for a long time. The regular PAC's where the executives of the company contribute money. The super PAC is where the company contributes money.

There's a big difference. One is the executive's own money-- executives or board members, and the other is my money is a shareholder of Apple. But if it directly affects the corporation, I take the point. But you do it for publicity and you do it for a variety of causes.

So I'm a right-wing Republican who owns Apple stock. Do I like you giving to a green PAC? You don't care, OK.

[LAUGHS]

AUDIENCE: [INAUDIBLE] [? also ?] [INAUDIBLE] Apple shares if the [INAUDIBLE] in the political [INAUDIBLE] is really that offensive [INAUDIBLE].

RICHARD SCHMALENSEE: Anybody from the other side of the room? Vivian, what do you think?

AUDIENCE: Sorry, I [INAUDIBLE]. I don't really know where we're at.

RICHARD SCHMALENSEE: The question is, should a corporation, let's say Apple, take a big corporation that has cash, make contributions-- not the executives. But should the CEO cause the company to make political contributions. And if so, when? And if not, why not?

AUDIENCE: Do they make political contributions?

RICHARD SCHMALENSEE: Should I go for the Reform America PAC that favors Ron Paul or the-- I forget what it's called PAC that favors Romney, or one of the Obama-leaning PACs or--

AUDIENCE: I think that's a really risky position to make as a [INAUDIBLE] interests of your shareholders, so--

RICHARD SCHMALENSEE: Shareholders might not all agree.

AUDIENCE: Right.

RICHARD SCHMALENSEE: Yeah. [INAUDIBLE].

AUDIENCE: Is it in the interest of the company, like in regard to Apple with imports from other countries in terms of manufacturing. Like, it's beneficial to the company and to the shareholders to maximize value in that way?

RICHARD SCHMALENSEE: So?

AUDIENCE: I think it's favorable that they're doing it for the company's best interests.

RICHARD SCHMALENSEE: So if it's somebody particularly focused on them. Ariana.

AUDIENCE: I agree. I think that, even if the company has given donate money to a cause that you don't necessarily personally support, [INAUDIBLE] as a shareholder, you [INAUDIBLE] [? their ?] interests separately. Like, you have interest in this corporation as pertains to making a profit, and you might also have separate personal interests. And so if personally, you want to donate to whoever you think has the right position on gay marriage, I think that's fine. But you should know that the interest in the corporation is purely about making a profit. So if the corporation is supporting a cause that furthers that goal, then that's fine.

RICHARD SCHMALENSEE: But gay marriage probably doesn't have a lot to do with my earnings as a shareholder.

AUDIENCE: So you shouldn't be worried about the corporation getting involved in that.

RICHARD SCHMALENSEE: Andrew?

AUDIENCE: So one thing about allowing companies to do these sorts of things-- I think that whereas in some situations, you can see the merit directly from banks, and there's this candidate that I know it's going to force me to have higher standards and all that stuff, I might want to go for the other candidate. But I think that having these sorts of rules allows for companies to go in this murky territory, where you're influencing things you probably shouldn't. And you increase your-- in terms of--

RICHARD SCHMALENSEE: Well, you're arguing you don't like the decision.

AUDIENCE: Sorry?

RICHARD SCHMALENSEE: You don't like the decision. You don't like-- but the decision's there.

AUDIENCE: What I'm trying to say is that a CEO doing something supposedly to improve the company's position is completely subjective, because giving money to candidate x might be interpreted as I'm doing it because I want him to support this, which is good for my company. But then there are whole other things that you're doing by doing, which I think is more of a negative publicity than positive publicity in the sense that you're influencing decision-making. Because it might be that you're doing it for him to support action A. But for action B, you also have influence on him. And then that might be that you don't want Apple to have influence on what he decides on something else.

RICHARD SCHMALENSEE: I've been on the board of a company that had one of these ordinary PACs. And the directors and the officers chipped in, and we made contributions. This was a company located on Wall Street, and we were a regulated company, a securities exchange.

And we made contributions to both New York senators and to the congressmen from Wall Street so that they'd return our phone calls basically. We're not going to buy influence. If they're not concerned about the fate of companies on Wall Street, then they're in a lot of trouble.

But to basically get your phone call returned, you make a few thousand dollar contribution. So that's different from giving $10 million to support Newt Gingrich. So Marie, you had a point, or were you were waving?

AUDIENCE: No, sorry.

RICHARD SCHMALENSEE: OK, Jacob?

AUDIENCE: [INAUDIBLE] a question. Is it possible for an international corporation to contribute to an American politician-- or like if it's an American company with, say, foreign executives who are making the decision whether or not appropriations [INAUDIBLE] giving money to a politician?

RICHARD SCHMALENSEE: Well, if they have a subsidiary that is a US person. So if you have a subsidiary that has a US charter, then presumably, that entity can. You can't make direct contributions-- well, sorry. They can't make direct contributions to the candidate in any case.

The question is, can you contribute to a super PAC? A foreign corporation doesn't have us rights of free speech. So I've never heard it brought up, but I think it could be barred.

AUDIENCE: [INAUDIBLE] question about whether it should be done.

RICHARD SCHMALENSEE: Well, I'd just set up a US company if I wanted to do that.

AUDIENCE: Yeah, in which case could there be anti-American interests that influence [INAUDIBLE] politicians?

RICHARD SCHMALENSEE: Yes, so I actually found an interesting-- there's a foundation called Sunlight Foundation. You can find them on the web. And they looked at who's making these contributions.

And in fact, you don't find any publicly held contributions. I couldn't find any. Certainly no company I'd ever heard of is on the list for contributions above $25,000. $20,000 actually was their cut. Lots of private corporations, individuals, unions, partnerships.

The only publicly traded company I could find is CONSOL, which is a coal company as far as I can tell. I don't know them well. They gave $125,000 to a Romney PAC. And you have to ask yourself, why? I assume that's a CEO who leans Romney and whose board is captive, which is not unheard of-- that the board is composed of his friends or her friends. I don't know who the CEO is.

So it's interesting that most large corporations, Apple, et cetera, are not playing this game, even though by law they can. I just find that interesting. And it has to do with what they think their role as CEO is and how they should behave. As I said, I could only find one publicly traded company.

There are a lot of so-and-so family company contributes, and that's a family company. It's effectively a partnership. So not publicly traded. So--

AUDIENCE: [INAUDIBLE]

RICHARD SCHMALENSEE: Which is?

AUDIENCE: [INAUDIBLE]

RICHARD SCHMALENSEE: Yeah. Yeah, yeah. Yeah. Oh yeah.

AUDIENCE: [INAUDIBLE] [? already that ?] maybe all the companies don't think Romney is going to win, so nobody's putting in the money [INAUDIBLE].

RICHARD SCHMALENSEE: There is a lot of money going in. And what we don't see-- if you look at what finances senatorial and congressional campaigns, you will see plain, old, ordinary PACs contributing, like the one I described, where I want to make sure my phone call gets returned, and I want you to be sure that you worry about wheat farmers-- so the wheat Farmers Association. But it is interesting, Obama has a PAC, but they're not sure he's going to win either.

So anyway, we'll come back to the lobbying and contributions. It's more for access than for votes I think. But, OK, yes, Stephen.

AUDIENCE: Just a quick question for that. You mentioned that there were private companies that were still doing this type of stuff? Could it be that some of the public companies are going through those means to make their donations?

RICHARD SCHMALENSEE: I think-- and they've talked about it that there are some companies that are dummy companies that get set up. But mostly, it hides rich individuals. So you can't follow through from this website.

But if you read in the paper, they talk about trying to track down donors and getting a post office box. So it's a company. It has a post office box. It's legally incorporated. Its documents aren't public because it's closely held.

So that's a mask behind which some rich person is hiding. I don't think it would be a sane thing for a big publicly traded company to hide that way, because if there were enough money, somebody will find it out. I mean, there's a lot.

Somebody gives $1 million and they're hiding, it's a good story if you can figure out who it is. If it turns out to be Apple, it's a scandal. So that's too risky. David?

AUDIENCE: Would it be possible that some of the larger companies, whose financial contributions would make a significant impact on the campaign, are companies that would already have access anyway? If Tim Cook called up the White House and said, look, we really need to talk to someone in the treasury or something, like [INAUDIBLE]?

RICHARD SCHMALENSEE: Yeah, Apple doesn't need to buy access. This mining company may. Backing Romney's not the most obvious way to do it.

So I assume that this is just a personal preference of somebody, and a board that says, yeah, sure it's $125,000. Who cares? We'll just cut your bonus.

OK, it's an interesting issue of the role of the corporation. But it's also interesting what most of them choose to do. Let's go to upstate New York and do formaldehyde.

I just answered that question, so we've lost that one. What's Darren's issue in the case? Matthew?

AUDIENCE: He's [INAUDIBLE] part of [INAUDIBLE] [? opposing ?] the [INAUDIBLE].

RICHARD SCHMALENSEE: But what problem is he addressing, or what opportunities is he addressing. What's the--

AUDIENCE: [INAUDIBLE]

RICHARD SCHMALENSEE: [? Other ways ?] to heat their venting. A lot of steam. Anything else it does? Scott?

AUDIENCE: Also, the steam causes damage to the building, and it corrodes the materials in the building. And it also causes an ice sheet on the ground, which is dangerous for employees.

RICHARD SCHMALENSEE: Lovely stuff, lovely stuff. OK that's what he's got. He has three options to deal with these that he considers first of all. Do you recall what they are? Rachel?

AUDIENCE: [INAUDIBLE]

RICHARD SCHMALENSEE: Yes.

AUDIENCE: [INAUDIBLE]

RICHARD SCHMALENSEE: Lithium bromide, bromine, yeah. Anybody got the third one? [? Wyatt? ?]

AUDIENCE: Everyone [INAUDIBLE] speed the flow of water between [INAUDIBLE].

RICHARD SCHMALENSEE: Speed the flow of water through, so it just comes out hot, it doesn't come out of steam. OK, why is he focused on combined heat and power? Why is he focused on co-generation? What are the issues with the others, of the advantage of this in broad terms? Kirsten?

AUDIENCE: The disadvantage for speeding up the process of producing hot water was that they didn't have a good place to put the hot water, especially in the summer. They didn't want to just dump it into the environment because that might have a detrimental effect on the environment, [INAUDIBLE].

RICHARD SCHMALENSEE: And just dump it in a cool stream, yeah.

AUDIENCE: Yeah, so they said, in the winter, they could heat the buildings without using too much electricity [INAUDIBLE] going to be a problem. And [INAUDIBLE] was that it would require a lot more [INAUDIBLE] changes.

RICHARD SCHMALENSEE: OK, so we focused on combined heat and power. Did anybody look at this? If it saves money, does it save much money relative to the firm's revenue-- to that plant's revenue? [? Obedah. ?]

AUDIENCE: In terms of, I think, power [INAUDIBLE] cleaning the water or treating the water, so that they can make it soft, because it's usually hard, you save 75%. But that's only like $10,000 or $8,000. But they make millions upon millions of dollars. And savings are in the low hundreds of thousands.

RICHARD SCHMALENSEE: Low hundreds of thousands, right. If you calculate-- there's a typo in the case where it talks about five days absence being 0.01%. It's, in fact, 1%. And if you use the other numbers, that plant has an annual revenue of about $5.1 million based on the production numbers they give.

You worked the numbers, Veronica. Good. So what I get is that the savings would be maybe 2% of revenue, the pre-tax savings, to compare pre-tax to pre-tax. OK, so not a big deal. We're going to talk about whether it's a good deal, and we're going to talk about whether they'll do it.

Let me just do a short riff on combined heat and power and waste energy. It's interesting, if you look at the rejected energy versus usable energy by sector-- so this is waste. Transportation, 75% of what goes in comes out as waste energy, electric generation just about a third, and every place else about 20%.

And you all know the answer to that, what form the waste takes, yes? Waste energy is usually heat, yeah. So, I mean, this one, transportation's tough, because cars are not all that efficient really. But for public transportation, this is a tough one.

Residential and commercial, an awful lot of the energy is going into heating and cooling. You can make it more efficient of course, but it's hard to capture. What's attractive about industrial and electricity is you have high heat.

You have large delta t. You have the ability to use a big temperature differential. And that's the whole combined heat and power story, that there really are two basic forms.

And the case kind of mentions it. The first is called district heating, where you take waste heat, relatively low temperature, from electric generation, and you pipe it around to heat buildings. The Danes did a lot of this. One of the readings mentions that.

It's also interesting, the Soviets did a lot of it. It requires you to have power plants relatively close to offices or factories or homes, so it's not the greatest thing. And of course, it makes more sense in a cold climate.

Using waste heat to heat buildings in Arizona is not necessarily a great deal. We put in subsidies in 1978-- we'll talk a little bit about PURPA at some point, that we're supposed to encourage district heating. It didn't do much for a variety of complicated reasons. It's generally acknowledged as a good thing in lots of places, but we don't do very much of it in this country for a variety of reasons. The other is electricity generation, and there are two versions.

The first is basic combined cycle gas turbine, which is relatively recent-- I should be able to date it, but I can't, maybe the '70s, maybe the '80s, generation technology. That's how people are building efficient gas plants these days. You run a combustion turbine which has a hot exhaust. You recover the heat from the hot exhaust, which makes steam which drives a steam turbine. Combined cycle, CC-- so you got two cycles working and basically two generation units.

This is pulled off a Siemens website. This can be a very efficient technology. and it's the same notion of capturing waste heat. All you mechanical engineers more about this than I do, but others may not.

And this is the proposal. This is the kind of proposal-- this is pulled from the case. This is the kind of proposal that our friend Darren is considering. This shows a boiler, but it has to do, as you know, with the heat from that exothermic reaction that makes formaldehyde.

So this is what he's considering. He's considering a simple system that takes steam to drive a turbine, generate electricity for internal use, maybe for sale. You cool it down, you recycle, it you pump it through. You will have to use some water, but you'll pull a lot of the water through. And the stuff that comes out will be basically cooling the condenser.

So this is what he's got. There are a lot of benefits of this kind of system in general terms. You can reduce energy expenses. You could worry. It could avoid the risk of varying energy prices, a lot of security, good environmental benefits-- mom and apple pie.

But the question that Darren faces is, is it a good deal? I want to mention two concepts that the case kind of puts forward and the spreadsheet puts forward without defining them. And I'll talk about them briefly.

So if you've got a vector of cash flows CT, that's the net present value. You just discount all the cash flows. The case talks about the payback period. And the payback period is the smallest time, such that basically, you get your initial investment back, assuming there's an initial investment up front, and then returns in subsequent periods.

You go out as far as you need to recover the initial investment. This is a very old-fashioned way of making investment decisions. And the problem with it is stated there, because it matters what happens after that time.

I tell you that you invest $100 today, you get $50 a year from now. $50 two years from now, the payback period is two years. If that's all, that's a terrible investment. You've just given me your money for two years.

What really matters is, OK, what happens after that? What happens after, and the longer the payback, all else equal, it may be the [? worse ?] the investment. But you can have a really terrible investment with a short payback period because it dies. So the case talks about it.

I just want to caution you, by any sort of reasonable standard, it's something you want to look at perhaps, because it may be a horseback way of thinking about risk. After two years, we're playing with house money, because we've gotten our money back. Andrew, you have a comment.

AUDIENCE: [INAUDIBLE] when I was [INAUDIBLE], I assume that even though it's not the best metric to make a decision, you could make a metric to see when your customers are coming in terms of if I have something that has a payback period of two and a payback period of 15 years, I just know that I have high risk in terms of when I get my money back with the second one.

RICHARD SCHMALENSEE: No, I think that's right. But you also want to just look at the nature of the risks. If I tell you it's a bond, then you don't worry about it. If I tell you it's a nuclear plant, OK, the nuclear plant has a 20 year payback.

But if it runs for 40 years, it's got a high net present value you're right to say, wait a minute an awful lot can happen-- see Germany, see Japan. So maybe I don't want to do that. But that's the main argument.

The internal rate of return is also sort of interesting. You can think about the net present value as a polynomial. Well, it's a polynomial in 1 over 1 plus r.

And you can say, well, suppose-- we're doing this chalkless? Suppose that this is the net present value, and this is the discount rate. Then what you might expect is that if you make an upfront investment, you get returns over time, the higher the discount rate, the lower the net present value, this point would be the internal rate of return.

Now, what's interesting about that is that when the picture looks like that, you don't have to get too fussy about the discount rate, as long as it's below r star. That's what it's good for. It says, well, I know it's got a positive net present value back here. So if the discount rate's somewhere in this range, but I'm not sure where it is, I know enough to know the net present value is positive.

But the graph could look like that. It could look like that if [? at ?] the end of the period, it is a nuclear reactor, and we've got to clean it up. OK, then high discount rates make that cleanup cost smaller in present value terms. It's a polynomial, so the number of sine changes is related in ways I've long since forgotten to the number of real roots.

If there's only one sine change, you're only going to get one real root. But if you have negative returns at the end, you can get two. I suppose you can get more than two. The normal thing, and that's what the slide says, is to call the smallest one r star. I think that's a little weird.

The other thing to keep in mind-- again, if you just graph these, you can say here's project A, here's project B. A has a higher internal rate of return than B. But for discount rates back here, you'd prefer B if you have to choose.

If you have limited funds, they have the same upfront cost. Your discount rate is in here. B has the higher net present value, you'd pick it.

So ranking by internal rate of return doesn't give you a desirability measure. It just gives you some confidence about-- it allows you to be uncertain about the discount rate and still make a judgment about present value. OK, questions about those? David?

AUDIENCE: [INAUDIBLE] [? talking about ?] the payback here, [INAUDIBLE] value [INAUDIBLE]?

RICHARD SCHMALENSEE: No. Normally, that's how they do it. [INAUDIBLE]. I don't worry about interest rates. Don't give me that fancy stuff. When do I get my money out?

And you could see the problem. As I say, I could give you a one year payback period. That's a lousy investment. That's pretty easy. Give me $100 today, I'll give it back to you in a year.

One year payback, fabulous. Not a good idea. So it's hard to imagine, but you can read texts in the '50s that are debating the merits of payback versus net present value. And you say, wait, how?

Anyway, what I want to do-- unless there are questions about any of this, or general questions about combined heat and power, I want to go to the spreadsheet. It didn't occur to me to ask, because of course this is MIT, but how many of you have played with Excel before? Oh, good, that's what I thought. I feel so much better.

All right, let's go there. That accords with my priors. All right, so there we have the spreadsheet. Is that readable more or less in the back?

AUDIENCE: [INAUDIBLE]

OK, and let's walk through a set of questions. Let's figure out how to walk through a set of questions. Hiram, what's happening here?

AUDIENCE: [INAUDIBLE]

RICHARD SCHMALENSEE: That's what you got to do? Turn the side screen on? All right. No. All right, this works [INAUDIBLE]. Thank you.

If you walk through this, this illustrates my point about depreciation. You get total savings, total expenses, gross margin-- that is to say what does this thing throw off in terms of total savings per year? You can subtract depreciation and get earnings before taxes if you want to.

But then you'll notice what happens. They compute taxes and they add back depreciation. It appears here and it appears there.

Depreciation is a game you and your accountant play with the tax people. So when calculating the after tax in your pocket savings, you have to say what depreciation do I get to take. How does that affect my taxes? That's it. That's it.

If you get faster depreciation, your income is lower and your taxes are lower. Your income being lower doesn't matter. Your taxes being lower does.

Is that reasonably straightforward? Because you're going to see this in later life, I'll guarantee you. And it shouldn't be mysterious.

It really is-- and it's an accounting entity. You report it on taxes. Some companies use different depreciation schedules for taxes than for financial reporting, which you're allowed to do to some extent.

OK, question, I talked before about the difference between doing things in real terms and doing things in nominal terms. Assuming this is Darren, not some Sloan student who wrote up the case, what's Darren doing? Is this a real analysis, a nominal analysis? Is he confused? [INAUDIBLE] what do you think?

AUDIENCE: I'm confused.

RICHARD SCHMALENSEE: Huh?

AUDIENCE: I'm confused.

RICHARD SCHMALENSEE: You're confused. OK, say why.

AUDIENCE: I don't [INAUDIBLE] understand how [INAUDIBLE] depreciation [INAUDIBLE].

RICHARD SCHMALENSEE: On what?

AUDIENCE: I don't understand how I will characterize it as either [INAUDIBLE] [? real ?] or inconsistent. Like, is this the nominal what things should be, or a nominal like interest rate?

RICHARD SCHMALENSEE: Well, what I said last time was, if you want to assume that prices don't change, in this world, where prices do change, then you'd better use a real discount rate that measures purchasing power. If you want to use the kind of rates you see in the market, those rates are based on people's expectations about inflation. So you'd better build in expectations about inflation.

What people often do-- and it's a mistake, is to use discount rates or interest rates from the market and assume prices don't change. So is he inconsistent like that, or is he consistent? I'll give you a hint.

A 10% real rate would be amazing. That would be very, very high. Not amazing, it would be high. [? Mathoura? ?]

AUDIENCE: [? I mean, ?] [INAUDIBLE] doing a nominal analysis

RICHARD SCHMALENSEE: Doing a nominal analysis, yeah, because he builds in-- he has explicit assumptions about inflation, and he's got an interest rate that's 2003. That's a market rate in 2003. No reason you would know that.

But you see the explicit inflation numbers at a fairly high interest rate. So he's doing a nominal analysis. It looks consistent. Is there any defense in the spreadsheet or in the case as to the choice of discount rate? Sarah?

AUDIENCE: I don't remember there being a very specific one, but I'm assuming [INAUDIBLE] comparable risky assets on the market.

RICHARD SCHMALENSEE: Yeah. He didn't say it, though. There's no discussion of where that 10% came from. After all of that incomprehensible nonsense last time about beta, I was giving you what you ought to do, not what people often do.

And clearly, what he did here was to take a horseback reasonable rate. Let's say at 10%. That's pretty much in line with cost of capital you see and discount rates you see. You would like him to have done more. This is not necessarily an ideal.

Are the inflation assumptions reasonable? Anybody react to those? What do you think? 2% electricity, 2% maintenance, 2% chemicals to be added to the water.

AUDIENCE: [INAUDIBLE] looking at interest rates on a yearly basis I don't know.

RICHARD SCHMALENSEE: I'm shocked.

[LAUGHTER]

[INAUDIBLE] shocked. I assumed that's what people around here did. I certainly do. I mean, these are not implausible numbers. I mean, if you look historically at inflation rates, they run in this country 1% 2 and 1/2% So 2% is reasonable.

What you don't see in this spreadsheet-- what you might like to see in life is you might like to see, well, does the choice of discount rate matter? You can check it easily. Enough we could put another rate in.

Do the inflation assumptions matter? Is the outcome sensitive to these things that don't get defended much? If you were doing this for real, and it was your money, you'd want to do that. You'd want to say, OK, I'm not too sure about those assumptions.

Are they critical? Do they drive the answer? If they do, you'd want to look harder. We don't see any of that. We may be missing a dozen spreadsheets in the background, but we don't see it here.

OK, as you read the case where are there risks on this sheet? Jorge, anything here that's not certain? You think it's all pretty rock solid. Matthew?

AUDIENCE: I think something that we didn't really bring up is that the company [INAUDIBLE] that the installation time took much longer, or even a day longer, [INAUDIBLE] production would set back the offset of the cost [INAUDIBLE].

RICHARD SCHMALENSEE: Yeah, we don't see the lost production here, and there is presumably some risk there. And that's related to the installation cost for which we have only an estimate. We don't have a guarantee. Rachel?

AUDIENCE: Something that [INAUDIBLE] jumped out to me was that I'm assuming that they did get that grant, because there's been a lot of policy talk about getting rid of them [INAUDIBLE].

RICHARD SCHMALENSEE: Yeah, I thought that was pretty bold to say, well, I know-- the text says we're pretty sure we can get this matching grant for $172,500. So we'll just assume we get it. And there's no lost production in here. [INAUDIBLE]?

AUDIENCE: [INAUDIBLE] during that time was much more reasonable [INAUDIBLE]. I think nowadays it might be much more difficult after the financial crisis. But before then, [INAUDIBLE] leading up to 2007, it wasn't very different for [INAUDIBLE]. I mean, comparably. If you-- I think about [INAUDIBLE] [? I'm ?] sure that argument was probably fair for nowadays, but not necessarily the case back then.

RICHARD SCHMALENSEE: If I were a naysayer, I'd say, do you have that in writing? Do you have that grant? That's big relative to the whole upfront cost. And he didn't quite mention that. Yeah.

AUDIENCE: Really, I mean, companies like Tesla and Fisker Karma got like half a billion dollar loans for their [INAUDIBLE].

RICHARD SCHMALENSEE: Yeah, but this is a New York State-- I don't know this program, or I certainly don't know what this program looked like in 2003. All I know is that the case said, can probably get the grant. I would say, gee, I'd really like to know, how does this look without getting the grant? I mean, do we know we're going to get it?

Suppose installation-- in fact the installation cost, didn't they say $120,000, $125,000, and he said, I think we can get it down to $100,000. Isn't that right? Yeah, thank you. I need support. So anything else that's uncertain here that you might want to focus on? Julian?

AUDIENCE: I don't see any removal costs on there [INAUDIBLE].

RICHARD SCHMALENSEE: Removal costs? You mean when you scrap it at the end?

AUDIENCE: Yeah.

RICHARD SCHMALENSEE: That's a good point. That's a good point. He doesn't talk about it. He runs it out for-- I forget how long this spreadsheet runs.

But he didn't talk about what-- presumably, you wouldn't throw it all away, since some of it's pipe. But maybe you would. I mean, it's a pipe with water, so it should last pretty well.

But the generator you'd have to replace, and the turbine you'd have to replace after a while. You're right, there's none of that. But I guess you could think about-- well, the question is, is there a disposal cost?

AUDIENCE: [? Yeah. ?]

RICHARD SCHMALENSEE: Yeah. The question isn't would you have to replace that, because you probably would. The question is, should there be a negative number at the end? Or could you sell it for scrap?

And he didn't mention that anything else? OK, do you like his treatment of these risks? Darren is not our favorite person here. Yes.

AUDIENCE: Well, the thing is, since we don't know exactly how he came up with that discount rate, then there's a possibility that he's not really accounting for the risks and the cash flows. I mean, the discount rate is low. But maybe he took that into account when he calculated the risk premium associated with his discount rate.

RICHARD SCHMALENSEE: Maybe, but-- is this my next question? Yes. Did he use pessimistic figures, optimistic figures, or more or less middle of the road figures? Pretty optimistic, yeah. Chad, you agree, optimistic?

OK, it's an interesting presentational choice, because Darren knows all of this. And Darren could just say, well, yeah, I've been a little optimistic. But the 10% is high.

This project looks so good on his numbers that the better strategy would be to be pessimistic. So you could say, look, I mean, I was very pessimistic, and it still looked good. He didn't do that, or he didn't explore.

Again, if somebody shows you one of these spreadsheets in later life, or if when you're working for McKinsey they ask you to make one, for heaven's sakes, think about the central case. Think about variations around it. He didn't do that. He took the optimistic case. Kind of a surprise.

I think what he should have done is-- oops, let's get it up there. Yeah, he should have been central to the road. Here's a beta question. So the discounting applies to how do we value energy savings. Those energy savings are going to tend to be correlated with the economy, against the economy, not at all?

The energy savings, probably two components. One, what's the production volume? And let's take that as fixed for the moment, because they do. You tend to run the thing flat out unless things are terrible. And the electricity price-- which way is the electricity price go with the economy? Brendan.

AUDIENCE: [INAUDIBLE] [? doesn't vary ?] much for the economy. I'd say that's more [INAUDIBLE] energy in terms of gasoline and stuff. That's more of a-- that varies a lot more with economy, but--

RICHARD SCHMALENSEE: There's a lot more. But if you have high demand, there's going to be a supply curve. Particularly in New York, which is a market-driven electricity system, he'll be running up a supply curve. So a little bit with the economy.

AUDIENCE: Yeah, I wouldn't say a very high beta [INAUDIBLE].

RICHARD SCHMALENSEE: No, no, no. Not a very high beta, but a positive beta. Yeah, so maybe-- yeah.

AUDIENCE: But the thing is, if he was using whatever that he recovers for generating more electricity, then maybe that's the case. But if is using heat to sell to people, then he can say that that's something that's fairly-- people wouldn't [INAUDIBLE] [? vary by ?] prices. But maybe the economy-- people will need that heat regardless.

RICHARD SCHMALENSEE: But what's on the table here is generation. What's on the table is generation, not heat. He doesn't have a scheme to pipe the heat away. He has a scheme to use the steam to run a turbine.

So good point. It's cold in New York, even in good years and bad. But the electricity price is what's at issue here, the value of the savings. So you could argue you should use a somewhat higher discount rate than the firms over-- than the cost of capital to the firm as a whole, just because there's a positive beta. We'd have to look at the firm.

AUDIENCE: [INAUDIBLE]

RICHARD SCHMALENSEE: I have no idea. Does anybody know anything about the formaldehyde business? It's a very diverse group. No one does formaldehyde at all?

[LAUGHTER]

OK. I don't have a clue. They wrote the case as if you just ran the factory. They didn't talk about it being cyclical, and nobody talked about it none of the naysayers talked about much cyclicality. But I don't know. Brendan?

AUDIENCE: Yeah, I mean, I think people are still

RICHARD SCHMALENSEE: [? Necessary ?] uses, but it does have other uses, which the case discussed and I don't remember. But OK, what do you think of the most important assumptions in this spreadsheet? Rachel, what do you think?

Tough call, just staring at it, yes? You'd have to go and look at-- to answer that question-- and I raise it, because that is really the key question. If I'm a naysayer and he gives me the spreadsheet, I say, well what did you check? How sensitive is this to the discount rate, to the electricity price, to the electricity inflation?

How sensitive is it to variations in the installation cost? Does it matter whether or not you get the grant? I can't tell here which are the key assumptions, but a little fiddling with this can. Alex?

AUDIENCE: Wouldn't the grant be the most important assumption because it's like half of your--

RICHARD SCHMALENSEE: It's half the capital cost. If you go down, though, to his net present value, you say, well, that doesn't matter, because it's $172,500, and the net present value is ginormous. So lose the grant. The question is, what assumptions would turn it negative? And he didn't answer that

AUDIENCE: I mean, if it saved less than [INAUDIBLE] it would save.

RICHARD SCHMALENSEE: Well, there are a lot of things it'll do, but the question is which are uncertain? They describe the technology as pretty vanilla. So I assume that was not-- you're right.

That would do it. If you saved less [? if ?] the electricity price collapsed, if the discount rate were much higher, in fact for one reason or another. I mean, you could add them up.

I asked this question not because I expect you to be able to answer it, but because you always have to ask that question. What's driving this answer? What's driving this answer? Finally, did anybody see the mistake in computing net present value? Sarah.

AUDIENCE: He started in column C instead of column B.

RICHARD SCHMALENSEE: Bingo.

AUDIENCE: [INAUDIBLE] [? compare ?] savings, as opposed to cost.

RICHARD SCHMALENSEE: If you go here, he takes the net present value of-- it's C45, which is here. C45, which is the after tax net cash flow, that's the right thing, all the way out. But he forgot the initial cost. That's one of the most bizarre mistakes I've ever seen.

If you look, there's the formula-- net present value of all the savings. Well, what needs to happen here, it's got to-- not available in protected view. Do I trust the contents of the file? Of course I trust the contents of the file. We're all friends here.

What he needs to-- I see, because I erased. What I need to do here is I need to subtract the initial cost. That doesn't turn it negative, but it did make a significant difference.

You see what he did. It's one of these, you say OK. He took the after tax net cash flow. So he went down, added the savings, added-- that's maintenance savings.

You got savings on electricity, maintenance, and chemicals, which gets inflated. All these get inflated. You'll see the inflation rate coming in here, coming in, coming in.

Adds them up, subtracts the required maintenance, gets the net, gets the gross margin, so to speak, subtracts depreciation to get the impact on earnings. That would be the increase in earnings. Gets the taxes, adds back depreciation, does all that.

Row 45 is the right row. Net present value, forgot the initial investment cost. That's a bad move.

That's a bad move. OK, Darren, is not doing real well here. Did anybody look at the payback or the internal rate of return? [INAUDIBLE].

AUDIENCE: I just want go back to the assumption. You're also assuming that, for 10 years, your production of formaldehyde is going to stay the same.

RICHARD SCHMALENSEE: He's making that assumption. And we don't know how sensible it is, because we don't know much about the formaldehyde market. They say that they run the plant 24 hours a day, 365 days a year, and it's a highly automated facility. And he's assuming that will continue.

It's not clear what other assumption you ought to make. But you're right, that's a key assumption. If the plant shuts down or goes to one shift, those savings figures get cut.

AUDIENCE: I meant the actual science of it.

RICHARD SCHMALENSEE: Huh?

AUDIENCE: I meant the science-- like, if your delta e is less and stuff like that. Like if you have [INAUDIBLE] less than [INAUDIBLE].

RICHARD SCHMALENSEE: Well, you could do it. I mean, if it's proportional to throughput--

AUDIENCE: [? In ?] the case, it specifically states that the board mainly cares about [? corruption of ?] formaldehyde vis a vis use of electricity.

RICHARD SCHMALENSEE: I'm not sure I get it. They mainly care about formaldehyde, and he's assuming that we're just going to keep running it flat out, because the board cares about production. I mean, if the market dies or if there's a plant problem, that won't happen, and you just cut the savings proportionately. Well, you'd cut the savings on electricity and chemicals proportionately. I'd have to think about maintenance.

Yeah, OK, internal rate of return. How did he do that? It's ROA, and the formula is up there. You could tell it's an internal rate of return, because that's what Excel calls the formula.

And if you look at it, it's-- and 15% is an initial guess. It's an iterative procedure. It's B49 to R49, so it's the internal rate of return on the pre-tax cash flow.

Why would you do that? Why wouldn't you take into account the effective taxes? If you look at that, that's weird. You should do it up here, and we could do it.

I haven't. It's going to be significant, but that's just strange. That's just strange. And just for humor, you really have to look at the formulas in a spreadsheet. He didn't actually compute the payback per that slide I did.

You didn't actually see when you get your money back. He went up here and took the installed cost, divided it by the C21 minus C29. Yeah, divided it by what amounts to G30 at the C32 divided it by the annual savings in the first year. But the savings differ year by year, and he doesn't consider taxes.

So this is a good-looking spreadsheet. And what astonished me when I looked at it was, wait a minute, that's wrong, that's wrong, that's wrong. Otherwise, pretty good.

Otherwise, pretty good. Any questions about the spreadsheet? OK, let's leave this.

No I don't. Let's go away. And let's go back. I just put the spreadsheet with the formulas in the notes. Those are the issues we've talked about.

Now let's talk about-- let's see. Let's talk about the naysayers. So I'm guessing-- I haven't spent my life doing this spreadsheet.

But I'm guessing, if you run through all of the things that we've talked about, the basic assumptions look OK. The numbers, he's too optimistic, but his discount rate's probably a little high. So I'm guessing that if you fiddle and diddle, you will come to the conclusion that it does have a positive net present value.

First objection-- you are now Darren, folks. First objection-- if it's such a great idea, how come nobody else is doing it? And your answer is?

Obadiah, what do you say? You're going to just take that? You're not going to just take that. What's your answer?

AUDIENCE: [INAUDIBLE]

RICHARD SCHMALENSEE: Might be we're smart. Might be this is a chance to take a leadership position. Charlotte.

AUDIENCE: It could be that the reason they're doing this is because they do all that excess heat and steam that's hurting their plant, and maybe other people's plants are designed in a way that they never had that problem before, so [INAUDIBLE] considered it.

RICHARD SCHMALENSEE: Could be, although it sounds like a standard problem the way they describe the basic reaction. You just dump this stuff in a vat and it gets hot. Martha?

AUDIENCE: [INAUDIBLE] have the same issue with ice and [INAUDIBLE].

RICHARD SCHMALENSEE: They might not have the same issue with ice. And the ice is kind of a big deal. You're right. If you're in the middle of the desert and nobody can see you venting a lot of steam, you might just say-- of course, if you're in the middle of the desert, you may have a water problem.

[LAUGHS]

Actually, I think my response would be this is an opportunity to show leadership. But let's try the next one. What's your answer to that one? This is what I got, is I estimated the revenue.

Yeah, yeah, I love your net present value. That's just swell. But there's a risk here. There's always a risk here.

Yes, there's always a risk. We talked about outage. We'll come back to outage.

But, I mean, it's 2% of revenue. You're going to make the plant more complicated. And if you're lucky, we'll save 2% of revenue.

Why should we do that? It's going to be lost in the noise as production varies, as price varies, as everything varies. Why should we complicate our lives? Now, these kinds of things come up. Sam.

AUDIENCE: Well, one, you could say the whole-- you could play the whole green angle, like as if it were to make the environment better. But also you could say, like, in the future, we don't know what's going to happen to the price of electricity. And if it rises, it's a good insurance policy we have. And also, you can say the technology that we're adding has a pretty good track record. Like, it's not that complex.

RICHARD SCHMALENSEE: Yeah, I mean, this is not the first time this contractor has ever done it. So the risk doesn't sound like it's that high. 2% is 2%. Not bad. Anybody else? Ryan.

AUDIENCE: It's actually checking the formaldehyde process, so it's not complicating it in that respect. But there's also the safety issue, and like we said, the green issue, the safety issue being the [INAUDIBLE].

RICHARD SCHMALENSEE: Yeah. Got the safety issue. That's a risk. Boy, somebody slips and falls on that ice, and we get stuck with nice negligence, big medical bills, sympathetic plaintiff. It's really depressing. Scott.

AUDIENCE: So I think if you look at it in terms of percentage, it doesn't sound like very much. Like saying [INAUDIBLE] it's only 2% of our revenue, that doesn't sound very much at all. But if you say it's $300,000 we're saving, then while it may be only a small portion of revenue, $300,000 is a large amount of money to pretty much anyone.

RICHARD SCHMALENSEE: To a $5 million operation? I don't know, maybe. Yeah, yeah. It's not trivial in the absolute. Anybody else? [INAUDIBLE].

AUDIENCE: They're also going to use current employees to run the same thing. So I presume their salary would increase.

RICHARD SCHMALENSEE: I wouldn't want to presume that. I'd say their job satisfaction would increase because it would make their jobs more interesting. That's the pitch I'd use.

And it's a good point. You might want to see if you can get them behind it. You might want to talk it up. So you could say, well, I've talked up with the folks in the factory, and they actually like the idea. [? Emerson? ?]

AUDIENCE: [INAUDIBLE] having those same people [INAUDIBLE] working [INAUDIBLE] because they're more familiar with the [? cost is ?] [INAUDIBLE].

RICHARD SCHMALENSEE: It helps, yeah. These people know it. They want to keep the plant running. We all want to keep the plant running.

This actually is common. I mean, these paraphrase the objections in the case. I've added a little bit of what you always hear. This is another one. We can invest and grow capacity, as opposed to this complicating investment, and we want to grow the business.

You're not growing the business. If we didn't have money, well, then we wouldn't invest. But if times are good and we're selling this stuff, we want to make more of it, because that's how we grow. And your investment isn't a growth investment. James.

AUDIENCE: Well maybe by selling electricity and formaldehyde, you're diversifying both the [INAUDIBLE], which is even safer, even though [? it's not that much ?] electricity.

RICHARD SCHMALENSEE: So yeah, we're reducing the risk of our operation overall because of this electricity hedge. And that means growth is safer. You might try that. Yes.

AUDIENCE: [INAUDIBLE] experience with the technology that's more PR-friendly, in the sense that you have less [INAUDIBLE] [? gas. ?] [INAUDIBLE] it's easier to build things where you want to get less public outcry. And so that [INAUDIBLE] to [INAUDIBLE] grow that in the future.

RICHARD SCHMALENSEE: Yeah, of course, except-- I mean, we are making formaldehyde. We can't fake into flowers. [INAUDIBLE]? Yeah.

AUDIENCE: I think maybe finding a better solution to get rid of the steam could allow you to increase capacity, because if it's just lying around, there's probably a maximum amount of formaldehyde that you can produce and have this [? thing ?] creating ice.

RICHARD SCHMALENSEE: That's an interesting thought. So you're saying we could only do so much of this venting and ice and so on. And that may someday be a constraint on us.

AUDIENCE: Yes, in finding a better solution, that maybe [INAUDIBLE] enable them to expand it even more.

RICHARD SCHMALENSEE: OK, [INAUDIBLE].

AUDIENCE: So this process saving money every year can add [INAUDIBLE] to that year investment [INAUDIBLE] get your initial investment back [INAUDIBLE].

RICHARD SCHMALENSEE: Roughly year 3, yeah. Extra money.

AUDIENCE: Yeah, actually [INAUDIBLE] capacity every year after that.

RICHARD SCHMALENSEE: Oh, that's nice. That's nice if we play it right. I mean, you get this stuff. You're getting this.

They don't specify in the case who he's talking to. But presumably, this is a middle management group that passes on capital spending requests. So your response would be, look, folks, if this plant is more profitable-- which it will be, we're going to be able to use that to get more investment money to expand. We don't necessarily get to put it in our pocket because it's all part of the corporation, but it would be a good justification. Andrew.

AUDIENCE: What you could be doing with the-- that's kind of a question. What you going be doing with the money you're using to build this, [INAUDIBLE] by your discount rate essentially. So we can just argue that-- I mean because it's kind of an opportunity cost that they're mentioning, right? I mean, instead of spending the money to do this, you can spend to grow the business. But then you can answer, like, that's why I'm using--

RICHARD SCHMALENSEE: It is, except in most companies of any size, you basically do a capital budgeting process. We're going to invest x-- I mean, you shouldn't, but you do. We're going to invest x this year.

Your job is to figure out how best to invest it, as opposed to saying anything that has a positive net present value, we'll figure out how to fund it. And if you a great project-- and this is a way of just doing a regular systematic budgeting process. If you come up with a great, big, big project, then you go to top management and you say, I know this is over the capital budget, but.

But for little things like this, and for this company, this is probably a relatively small project. Darren doesn't have the discretion to do it himself. Routine things, he probably has a limit. You have a spending limit without approval of $20,000 maybe, maybe more. For anything above that, up to some ceiling, you got to clear it with whatever this group is that is full of skeptics.

Beyond that, the group has to go and say to top management, I know you only gave us $800,000 for the formaldehyde division. But we have this great idea, and we'd like to present it. So it economizes is on top management time to some extent.

It also gives you an orderly budgeting process, so you can predict cash flows. But it imposes this kind of constraint. I mean, capital budgeting processes do.

At some point, somebody sits in the room-- you've got a good project, I got a good project. We don't have money for both. And they're not so good that we can get money for both. We need to choose.

And there is a tendency to say we want to grow. We want to grow. That is an issue that investments in efficiency and conservation traditionally face because they're not growth investments, and people like growth. [? Obeida? ?]

AUDIENCE: I also [INAUDIBLE] mentioned this about the second point, but it might be 2% of revenue for one plant. But what if you have several plants? [INAUDIBLE].

RICHARD SCHMALENSEE: If it's like this plant, it's 2% of revenue for all plants, right.

AUDIENCE: If you install the system at a number of plants, you could easily end up with revenue like savings in the millions.

RICHARD SCHMALENSEE: You could end up with a good number. It would still be 2% of revenue probably on that order. OK, yeah. Another way to do that argument-- and it's a little variation on the first one, would be, look, guys, we can lead the way for the company, whatever this group is that's approving the budget.

If this works here, and we're very confident it works, we're going to get a lot of points with the company, because we led the way to 2% of revenue savings in all of our formaldehyde operations. Or maybe it's not 2% everywhere. We've got to run the numbers.

Electricity is probably particularly expensive in upstate New York. It would be cheaper in Ohio. But that's where I'd go with that. I wouldn't say 2% is-- 2% is big if I multiply it by a large number. I would say it's in our interest, as the group sitting around the table, to demonstrate to the guys up above that we can do this.

OK, here's another one. This is a killer. Our bonuses depend on production. That's how we do it. And you're telling me it's five days of downtime, and we can recover from it.

But we don't know we can recover from it. You're putting my trip to the Caribbean at risk, and it's very cold in upstate New York in the winter. I need that bonus. This is a risk.

What's your response, Casey? You look ready. You are ready on this one, am I right?

AUDIENCE: Well, first, they might be able to switch their production schedule to account for take those five days off then, because they're not running at full capacity all the time anyway.

RICHARD SCHMALENSEE: The case leads you to some optimism, yes.

AUDIENCE: And then, additionally, you can just go back to the [? handy ?] argument that businesses need to produce money, but they don't necessarily need to maximize their funding. So we can do this [INAUDIBLE].

RICHARD SCHMALENSEE: But this last point isn't about the business. It's about my trip to the Caribbean.

[LAUGHS]

And I care about that. This one's tough. I don't mean to put you particularly on the spot, but this one's tough. If you've got the compensation structure set in such a way that it biases toward growth and towards revenue, this is a tough one. Charlotte?

AUDIENCE: You can-- back to the point that we made on the last objection, where if you're the first plant to start [INAUDIBLE] something that saves your company 2% in revenue, and adds other plants then the heads of organization will look favorably on you, and [INAUDIBLE].

RICHARD SCHMALENSEE: We can get a bigger bonus if we can sell this. Tough argument. It's one you'd try, though. David.

AUDIENCE: You would get a promotion if you can demonstrate initiative among your scale of thinking. Because if you don't do it, and someone else implements it, they might displace you [INAUDIBLE].

RICHARD SCHMALENSEE: It works for Darren. It might not work for the guys one notch above Darren. It might, though. It might. Look, if you guys all get behind this, we'll all ride up the ladder together. Martha.

AUDIENCE: Going back to what was said about how, after your investment was returned, you'll be continuing to save money. So your close may be less this year, but they do much greater in future years, while they're able to start expanding that growth, and we're able to start-- so maybe instead of going to the Caribbean this year, you go to Vale or something.

[LAUGHTER]

But five years down the road, you can go to Jurassic Park. I don't know.

RICHARD SCHMALENSEE: Hey, ski in the Adirondacks instead of skiing in Vermont. I don't know. OK, anybody else? OK.

How about that? The case talks about all these policies. There's this killswitch problem.

There are other policies about interconnection. They're still in flux. Maybe what we ought to do-- it's a good idea.

OK, you've sold me. It's a good idea. Why don't we just wait? Let's just let this stuff settle. Maybe if we do it now, we'll have to take precautions we wouldn't have to take if they apply more sensible policies down the road. David.

AUDIENCE: You could argue none of the competitors are doing it now, so doing it now gives us a competitive advantage versus in the future, competitors are already [INAUDIBLE].

RICHARD SCHMALENSEE: But we are. But suppose the policy goes against us. Suppose instead of making it easier to interconnect that the policy change makes it harder. It requires us to put on more protective devices-- let's say $200,000 worth.

And then, all of a sudden-- that's extreme. But all of a sudden, the policies we were counting on, the ability to sell excess power, which is still in flux at this point, it turns out we can't sell it. Turns out we need to have more protection. Maybe we should wait.

Claudia, what do you say? You sold up with the skeptics? I mean, that's not a crazy point. No.

AUDIENCE: If it tends to approach local regulators directly and [INAUDIBLE] make a point of [INAUDIBLE].

RICHARD SCHMALENSEE: Well, one thing Darren might have done is he might have not necessarily approached them. But he might try to get a feel from, say, his local representative. A lot of this stuff is going on at the state level.

He's running a pretty big operation. He's one of the great polluters-- no, one of the great operations in the area. He might make a phone call and say, look, can you tell me where this stuff stands?

I mean, is it going to get resolved in six months, or is this a five-year marathon and it'll get changed every so often. That matters. If it's going to get resolved in six months, let's wait. If it's going to be debated for the next 10 years, why wait? Ariana.

AUDIENCE: I think this is where it would have come in useful for him to have made a more pessimistic analysis. And so maybe you do that first. And then you say, like, OK, well-- because, I mean, when we looked at it, it looked like, even if some of the estimates were a little bit more pessimistic, or you couldn't get the grant that you wanted maybe, or you estimated it with some of the policies not falling your way. And you could still-- maybe the profit wouldn't be as large.

But in the long run, it's still worth it. And you could come and say like, look, this is what I think is going to happen. I mean, you never really know. And even if it goes a little bit sour, like we still are making some kind of profit. So it's worth it anyway.

RICHARD SCHMALENSEE: OK, let me go to one last one. Who'd like to make the elevator pitch? Is there a spin he can put on this. So he walked in with his spreadsheet. He got all these arguments, all these nay-saying nitpickers.

What do you stand up and say? What do you stand up and say? Caroline, are you ready with an elevator pitch here? You ready with a one minute speech to make the committee turn around and charge out the door and go to the CEO and do it?

AUDIENCE: [INAUDIBLE]

RICHARD SCHMALENSEE: Not quite ready, OK. Anybody? [? Albina, ?] you're ready today?

AUDIENCE: OK. that's good. Sorry to disappoint you. I don't have an elevator pitch, but I'm curious as to what the outcome was of this case, because it's not [INAUDIBLE].

RICHARD SCHMALENSEE: Let me fish one more time for an elevator pitch. And then I'll tell you what I think happened, which is not unrelated to that question. Max?

AUDIENCE: You want to appeal to the interests of the board, and their interest is always the production and maximizing profits. So emphasizing the fact that this short-term investment will save a lot of money in the long run, which you can in turn invest in greater production in the future, which will give them bigger bonuses. You can also appeal, I think-- it deals with a couple of points to the safety of the workers and to the integrity of the whole plant. In the article, it talked about the ice being a hazard for the workers and the corrosion of some of the structure of the building [INAUDIBLE] as well.

RICHARD SCHMALENSEE: What I think happened, and it's not unrelated, to that my understanding-- and I've tried to verify it and I'll see if I can do it next time, is that in fact, when he presented it to the review operation, it was turned down for all of those reasons. And he managed to get the ear, one way or another, of the CEO, and he pitched it as industry leadership, green public relations. Economics are OK. Economics are pretty good, so we're not going to lose money on this investment.

But moreover, think about what we can say to the community. Think about what we can say to the workers. Think about what you can say at the next industry convention when you stand up and give your leadership speech. We'll get benefits.

I mean, we're venting steam. It's not hurting anybody, but it doesn't look good. It's got to look better.

So he went around these guys, is my understanding, and pitched it as an opportunity-- and not just an economic opportunity. He overstated the economics. The economics are OK.

But he pitched it as an opportunity. And we'll see next week, and we will see after the vacation, that whether you view something as a threat or an opportunity makes a lot of difference as to how you act on it. Thank you very much.