GLOBAL CLIMATE CHANGE: A BUSINESS MODEL APPROACH

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You've probably heard there are some pretty spectacular things going on outside in the world where Chrysler is allegedly going through a cooperative agreement with Mercedes-Benz. I can tell you this much — there definitely are negotiations going on. We have not concluded anything, and even if we do, we still have to get through our boards and our stockholders and all the other things we have to do, and I don't know any more about it frankly than you do, but this has been kept pretty quiet, as you might guess, at the very highest echelons of the company.

But I do want to thank you for inviting me here, and I've been invited to bring a business perspective to this workshop today. I hope that it will complement the perspectives that you've already taken from government, science and academia, and I appreciate the opportunity to present our side of how we should go up into a global climate issue. Now each of our disciplines here takes a different approach. This approach is probably similar to the one that many of you use to make decisions yourself. It includes several steps.

First, you define the issue — that is, you look at it from all sides and gather information. Secondly, you find the root cause and what brought this issue to the forefront in the first place. Thirdly, identify the time constraints — in other words, how much time do you have to make a proper decision to deal with the issue. Then develop alternative responses, and, of course, weigh these alternatives in terms of costs and benefits. And lastly, you bring it all together and recommend a course of action.

Now then I'd like to lay out the decision-making process from a business standpoint. I'd also like to apply it to the issue we're all here to discuss. When addressing serious questions like global climate, we tend to fall back on things with which we're familiar to deal with it. In the case of business, we take a process approach to decision-making, and let me show you what I mean. The first issue is defining the global climate change and what it may mean. I know that all of you are very familiar with this issue, so I won't go into a lot of detail, but let's just summarize it very quickly.

This is a chart (Figure 1) I'm sure all of you have seen in one form or another — world temperature records over the last 150,000 years. The data of course are based on ice core samples from Greenland and Antarctica. And, as you can see, there's a small correlation between the temperature estimates from the two sources, and also there have been some pretty wild swings in each period, both in warming and cooling trends. I'd also like to point out the area on the far right of the chart, which is the most recent period. It shows the temperature swings have been generally less severe the past 100 years.

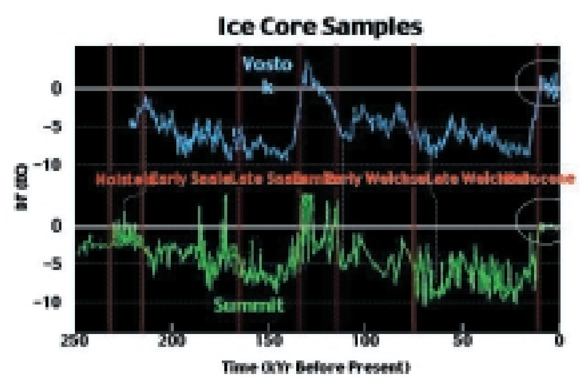


Figure 1: World temperatures over the past 150,000 years, obtained from ice core samples.

And here is a more detailed look at the most recent data (Figure 2). It shows that the earth's temperature has been gradually increasing just about a half a degree Centigrade or about one degree Fahrenheit from the late 1980s to the present. And you will also note that most of this increase occurred before 1940, and then there was a relative stable trend from 1940 to 1980 and then another rising and increase in temperature beginning after that. Other reputable studies from earth's satellites and weather balloons have shown a very slight decrease in temperature over the last 20 years, but I'm not here to debate the science with you – I think that's your job – let's just agree that there is sufficient cause for concern. Because this is a very complex subject, I think we all understand that much more needs to be learned and that the science is uncertain. In business when we face uncertainty what we tend to do is keep digging for more information, time permitting, of course. So we strongly endorse more objective research to help clarify the issue and understand it better. Now before you get upset, it doesn't mean we recommend doing nothing in the meanwhile. On the contrary, we are in the business to do things and to take action. I'll talk a little bit later, about what we are doing.

Recent Temperature Changes

Source: Trends '93: A Compendium of Data on Global Change

Figure 2: Average temperature changes across the U.S. over the last 150 years.

But first let's move on to the second step in the decision-making process — what is the root cause of global climate change? This research has shown the key is the greenhouse effect. There's no doubt there is a greenhouse effect, and thank heavens there is one because without it temperatures on earth would be about 90 ˚F colder than they are on the average [now]. But what's the root cause of the greenhouse effect? It is, of course, all greenhouse gases in the atmosphere. I'm sure you know that water vapor makes up about 97% of those gases. I can just add as a side, I'm somewhat perplexed personally why nobody pays any attention to water vapor because it is the most abundant greenhouse gas and in fact human activity contributes significantly to water vapor as well. After all, we burn fossil fuel that has water vapor as a by-product. We spray water on crops and lawns, we build reservoirs that contribute to evaporation and so on. But it's the remaining 3% of greenhouse gases I understand on which all the attention is focused. And certainly of those 3%, carbon is the one that has generated the most concern in terms of the effect on climate.

Again, here is a chart (Figure 3), you are probably familiar with, which measures the increase of CO_2 concentration in Honolulu, Hawaii. Since 1960 the concentration has increased from about 310 parts per million to more than 360. Where it gets interesting is when scientists cor-

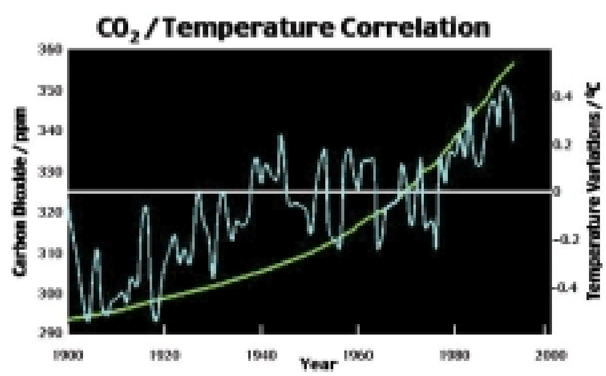


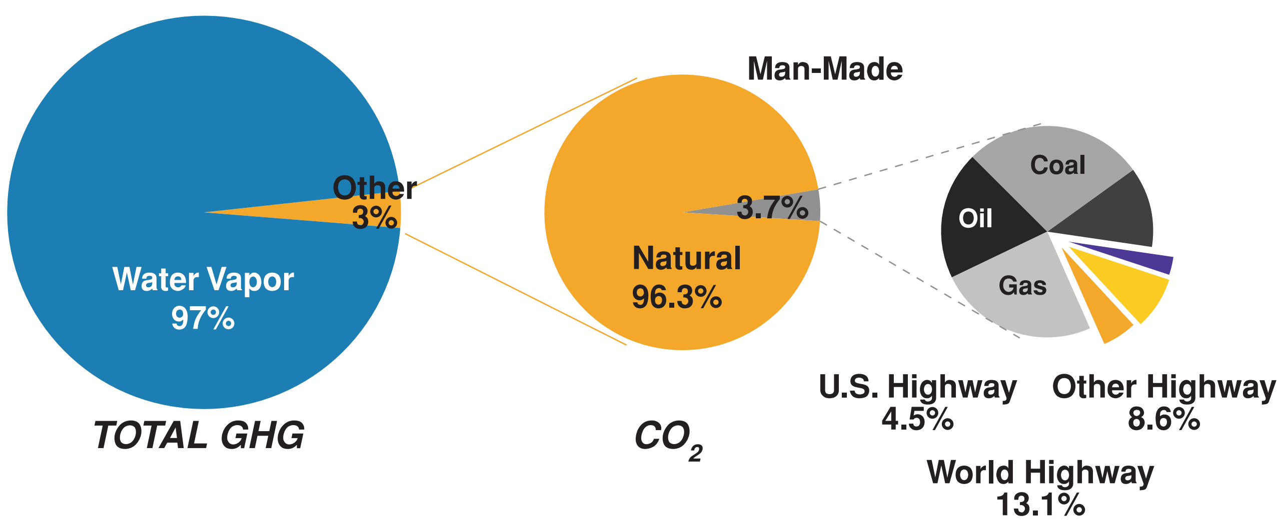
Figure 3: Trends in carbon dioxide (green curve) and surface temperature (blue curve) at Mauna Loa, Hawaii.

relate data like this with temperature data, and here's what it looks like. The rising CO_2 level does correlate broadly with the rise in global temperature levels. And to some scientists, it is more than a correlation – it is cause and effect. But by no means is that the only scientific correlation. Other scientists point to correlation between temperature and solar activity, ocean currents, aerosols, and other things. We know that all these things have an influence, but CO_2 is the one that is most talked about, and where does CO_2 come from?

Now, earlier we said that 3% of all greenhouse gases are not water vapor. The majority of that remaining 3% is comprised of CO_2, and of the CO_2, the majority comes from natural phenomena and only about 4% is man-made (Figure 4). If you multiply by 3.7%, man-made CO_2 accounts for about 0.12% of all the greenhouse gases. The argument of course is that even this small amount is enough to upset the balance of nature because CO_2 does accumulate in the atmosphere and it can be retained there for decades. And that influences the greenhouse effect. But then again, where is CO_2 coming from that is man-made?

Well, automobiles are often singled out as the major contributor to man-made CO_2, and the fact is cars and trucks are responsible for about 13% of all man-made CO_2, which we accept as our piece of the action and realize we have to do something about that. And we're working hard at that. But despite that, I want you to understand the point that even dramatic reductions in cars and trucks are not the sole bullet that's going to solve this problem alone. And even – it's interesting that even if every car and truck in the world were eliminated and not just became super fuel efficient, the total reduction in CO_2 would amount to less than one-half of 1%. In greenhouse gases altogether, if we go through the multiplication, it would be reduced by 0.0016.

So speaking as a representative of Chrysler, I'd like to make the point that autos are not the only



Eliminate all cars and trucks

- CO_2 reduction (13.1% X 3.7%) = 0.48%
- GHG reduction (13.1% X 3.7% X 3%) = 0.0016%

Figure 4: Breakdown of greenhouse gas contributions. Sources: IPCC, International Energy Agency, et. al.

• 20+ years before taking action results in approximately 0.2 ºC temperature increase over a 100 year period
– *Nature Magazine*

• "Delaying the implementation of emission controls for 10-20 years will have little effect on atmospheric concentrations"
– *US Congress Office of Technology Assessment*

or even the biggest culprit in the rise of carbon emissions worldwide. So we come back from the auto industry to the realization that while man-made CO_2 is an important contributor, other elements are also at work, and the root cause also needs more understanding. That's why we also support more research to help resolve these uncertainties. It's not an open-ended strategy, however, because despite the uncertainty, we understand that the clock is ticking and no one wants to see progress on this issue bogged down, especially if this timing becomes critical.

We know that the overall cast we have requires the U.S. to reduce greenhouse gases 7% below the 1990 baseline between 2008 and 2012, And what that means is more than a 30% reduction from what is called "business as usual" conditions. Is the timing contained in the Kyoto protocol reasonable?

In a recent article that appeared in *Nature magazine*, Research Unit in England concluded that waiting more than 20 years before taking action to limit man-made greenhouse gas emissions would result in about a 0.2 ºC temperature increase – but over a hundred year period. Now this confirmed an earlier statement by report from the U.S. Congress Office of Technical Development which said, and I quote, "delaying the implementation of emission controls for 10 to 20 years will have little effect on atmospheric concentrations." Now obviously different authorities have different interpretations of urgency, and I really don't want to get into that because I don't know what the resolution is, but they do seem to agree we can take some time to do this right without catastrophic effects. And I would add my observation that taking a bit more time to develop the right strategy is better than rushing into the wrong strategy.

But what is the right strategy? And that search begins the fourth step in our decision-making process to develop alternatives. Now in broad terms, business must develop alternatives or contingency plans to prepare for whatever outcome is possible. There are a couple of points that underline what our overriding philosophy is on global climate change. First, we believe that continuing development of advanced technologies is the best strategy. These technologies can permit sustainable development; that is, they can provide environmental benefits coincident with economic progress. And second, the timetable for these technologies cannot be artificially mandated. They will emerge as fast as market acceptance is achieved. And, believe me, the world auto-makers are aggressively engaged in a competitive race to be the first to bring advanced technologies to market because the first one that gets there is going to reap very huge rewards much like Chrysler did with our minivan. If you get to the market first, you've got a tremendous leg up on your competitors. But a critical element is to develop advanced technologies that people will want to buy and in fact can afford to buy because it's important that if nobody buys these, there will be no environmental benefit. We've seen that, for example, and what we'd like to avoid is a situation that's comparable to the current electric vehicle mandates, where automobile makers were forced to build vehicles and nobody bought them because they simply aren't acceptable yet. They have the technology problems, they have the cost problem, and until we fix those, they are not going to be bought in great numbers. So that's our overall philosophy.

Now let me take a look at some specifics in terms of facilities and in terms of our vehicles, and I'll use Chrysler examples. Regarding our production facilities, Chrysler's total energy consumption (Figure 5) from our plants breaks down – it is shown on the left of this line. We use 58% natural gas, 35% electricity, with the rest – it's pretty small – divided among the coal, coke, and oil in our facilities to produce cars. On the right-hand side you will see how much CO_2 results from this first commitment. Electricity accounts for almost two-thirds of the total, and natural gas about one-third.

Now we have no control over the CO_2 emissions that come from electric utilities, so the electricity part of this is not our piece of the action. Where we do have control is by moving away from coal and oil fired boilers and increasing the use of cleaner burning natural gas which we at Chrysler have pursued very aggressively already. But while we have made progress regarding the type of fuel we use, we now need to better control the amount of fuel that we use. That's because almost all of the fuel that we use is for heating our plants, many of which are in the northern temperate zones. Simply packing up our facilities and moving to the tropics is not an option. That would be socially and economically untenable. Besides, there are more promising alternatives we can use to save fuel that we are investigating.

Key amounts goes, for example, a great deal of our fuel used goes towards running our paint shops which require a lot of air transfer. The simple solution is to reduce the amount of air going through these shops that doesn't have to be heated, and that is what we are attempting to do with something called the powder paint process. In conjunction with GM - Ford and paint suppliers we're developing new paint material and processes that require fewer air exchanges and create fewer emissions, that contribute to ozone formation. And that's because these powder paints simply bond magnetically to the sheet metal and they don't require spraying.

Turning now to our on-road vehicle programs, most of our advanced technology developments are within the Partnership for a New Generation Vehicle or **PNGV**, as you probably are familiar with. This is a government-industry relationship, which has a target to achieve up to 80 miles per gallon in fuel economy in the mid-sized sedans. We are developing both alternative power trains and alternative materials to lead us to this goal.

Let me show you some examples of each. Here's our EPIC (see photo on next page), which stands for Electrically Powered Interurban Commuter. It's our minivan. We've already placed these in government service and more will be available this fall. And very soon we'll fit these mini-vans with advanced *electro-metal* high-drive batteries for longer range and useful life.

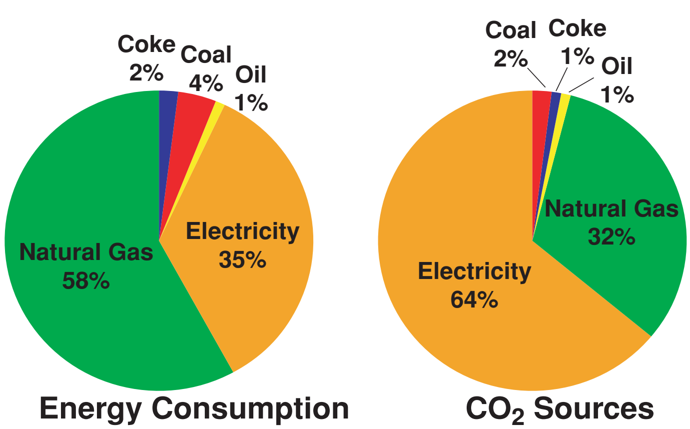


Figure 5: Chrysler energy consumption breakdown for Chrysler's production facilities. Source: Chrysler Corporation.

This is a Dodge Intrepid ESX2. It's a hybrid vehicle. We introduced this at the North American auto show in Detroit last January. This vehicle is a second-generation hybrid in development at Chrysler. It's termed a hybrid because it uses both a small diesel engine and an electric motor, whose batteries are charged on the fly by the diesel engine. It could get up to 70 miles per gallon, but with comparable room and cargo space as the Intrepid that we sell today.

In the more distant future, a ways away yet from the commercialization, is the advanced fuel cell that we are developing. It uses hydrogen extracted from gasoline to produce enough electricity to power the car. And although fuel cells can also create hydrogen from methanol — a lot of other manufacturers are pursuing methanol — Chrysler is interested in gasoline-based technology because the fuel infrastructure is already in place across the country, which makes it more attractive to people who will determine the success of any fuel cell powered vehicle — once again it's the customer. Somewhat less revolutionary powertrain developments include the Compression Ignition Direct Injection or CIDI engine with a continuously variable transmission. Developments like these and others are showing great promise of fuel efficiencies, and these will be available in the near term.

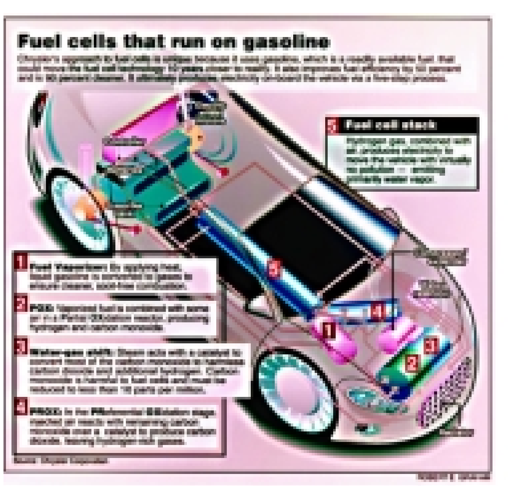


Figure 6: Schematic of Chrysler implemented technology for gasoline-powered fuel cell vehicles.

Next I'd like to show you briefly a few examples of our work in advanced development materials. As many of you know, this is our production street rod, the Plymouth Prowler (see photo below), which went on sale last year. While it is mostly known for its retro design, the Prowler is also noteworthy for its use of alternative materials and production processes. It has a frame and body of primary aluminum while magnesium composites of plastics also play important structural roles. This is a learning tested for aluminum intense vehicle with a very limited production time. We are hopeful the lessons we learn here will transfer to a large-scale production vehicle, because, after all, why wait to use better fuel economy. Our work on advanced materials for volume production cars and trucks also began but they're not right for sports cars shown on the left. With the Viper we learned that large-scale composite molding is something

we can do. We've taken that work to a much higher level with our Chrysler Composite Vehicle or CCV that is shown on the right. Interestingly, the CCVs entire body is molded out of just four parts and is joined with fasteners and adhesives. And by the way, it's molded from a plastic resin similar to what soda pop bottles are made from. All in all we are not sure which of these technologies will provide the proper mix of vehicle attributes, and the affordability to achieve market acceptance. We can build these products, but to realize environmental progress, people have to buy them. And technological breakthroughs don't happen according to a predetermined schedule, so it's impossible to predict when we would be able to sell them in quantity.

However, I can predict that it's unlikely that Chrysler or any other automaker will be able to meet a 30% reduction in CO_2 emissions by the period from 2008 to 2012 as mandated by the Kyoto protocol. Now why is that? Well, first of all, they're not in production. And it also takes years to develop And test these new revolutionary technologies. It also takes years to convert our facilities. But most important of all is the issue of how long it takes to change what's already on the road. This line shows total new versus used vehicles in use in the U.S. in 1997. As you can see, only 7% are new purchases. Chrysler contributed only 1% of that, and 93% were used cars and trucks. So what I'm suggesting is that even if the auto industry already had all these technologies – which it doesn't – and even if we converted all of our facilities to that technology today – which we haven't – it would still not be able to meet the Kyoto objective because it takes 15 to 20 years to turn over all the fleet of used vehicles making an impact on the air.

That's not to say we're not doing anything, but what we're trying to say is even if we do all this stuff, don't count on it making a big contribution to CO_2 reduction by the time period of the Kyoto protocol. And, of course, to achieve a 30% reduction in the short term, what will probably be needed are draconian measures to force reduced usage or people's vehicle miles traveled through measures such as gas rationing or advanced price increases, neither of which are very politically attractive. And of course it's likely that the economic impact of more than a 30% forced reduction under the Kyoto Treaty will go far beyond fuel prices.

Charles Rivers and Associates, a respected economic analysis firm, estimated these effects on the Great Lakes States that we're talking about

Economic Impact of Return to 1990 Greenhouse Gas Level (2010)

	Gross State Product	Jobs (000)	Avg. Income
Michigan	-0.7%	-44	-3.0%
Wisconsin	-0.7	-33	-3.1
Minnesota	-0.9	-25	-2.9
Illinois	-0.9	-59	-3.2
Indiana	-0.6	-44	-3.8
Ohio	-0.6	-60	-3.3
Region Effect	**-0.7%**	**-265**	**-3.2%**

Source: Charles River Associates (1997)

here on this stage – if carbon dioxide emissions simply had to equal 1990 levels by the year 2008 to 2012 – this was done prior to Kyoto, and of course Kyoto is now 7% below stabilization levels, so it makes it even tougher. That would mean there would be across the board declines in gross state profits as well as declines in number of jobs and therefore in income.

The bottom line of all this is that even if the U.S. and all developed countries in the world obligated to reduce CO_2 by the protocol achieved the objectives in the prescribed timetable, worldwide CO_2 would still increase 32%, and that's not my estimate – that's from the U.S. Energy Information Administration.

Now why is that? It's simply because all developing countries, as you know, have no obligation to the Kyoto protocol, and their emissions of greenhouse gases are increasing faster than the developed world. So the developed world could go through all the suffering and economic pain, and little environmental progress would accrue.

In summary, let me say that Chrysler shares concerns expressed by many that the global climate could affect future generations and accordingly we support actions to understand science better. We also believe that access to the most advanced technologies and voluntary implementation in the competitive marketplace are the best responses to this environmental challenge. But we do recognize that no environmental benefit will be realized unless we insure that our technology meet buyer needs and all bases contribute to a global solution. And finally in our judgment, implementation timetables are unnecessarily aggressive, and it would seem prudent to take the time to do it right.