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Thank you very much, Maria. Your last point is precisely what we will cover in the second part of this session, but I would like to pick up on what you said about the fact that we were facing a structural issue. We say that we are of course interrogating whether what is happening in the US is sustainable or not in terms of pricing, and there I turn to André Caillé to ask him this question. There is this North American energy revolution, although the chairman said it is not a revolution, so a situation, let us say, and we have the feeling that America is rediscovering competitiveness. Some industries, such as the petrochemical industry, is booming there. How sustainable is it?

André Caillé, just to introduce you briefly, you are now director of several corporations and you have had an extensive career in the energy sector. You have chaired Hydro-Québec, you have chaired Gaz Métropolitain and you have also been the chairman of the World Energy Council, so can you tell us more about the energy situation in the US and Canada,?

André Caillé, Director of Junex, Canada

Thank you very much, Excellency, Chairman, ladies and gentlemen. As you can see from the names that were published for today's schedule, I was a late addition, so I will try to be very direct with you. First, let me say that there is a revolution in the North American energy sector at this time. It started when I left Hydro-Québec seven or eight years ago. Up to that point, 2005–2006, we all thought that the US would remain an oil and gas import country and that the US conventional natural gas reserves were declining. US conventional oil reserves were developed, mostly offshore, but development could barely satisfy increase in demand. The power sector in the US was dominated by coal, it has been used for primary energy in a proportion above 50%. Hydro and nuclear development were not seen as feasible, although significant hydro power imports went to some states, namely California, New York and the states in New England. Some wind and some solar power was developed, supported of course—as in Europe—by government or tariff subsidies.

On their side, Canadians were comforted with their larger (compared to the US) gas reserves. We had 10 to 12 years of gas reserves. More than half of Canadian natural gas production was exported to the US. At one point, it reached up to 60% with the construction of large transcontinental pipelines from Western Canada to the New York and Chicago regions.

Canadian oil reserves were growing. Oil sands production had started and was known to be feasible with the technologies available at the time, technologies developed as part of an ongoing process—"as we go" as we say in Canada—and they were producible at a cost of between 35 and 40 dollars per barrel.

The largest environmental impacts came from coal combustion, namely CO₂ emissions from inefficient plants. They also emitted pollutants that greatly affected the air quality of the surrounding areas. The second concern was the construction of large reservoirs, considered as non-renewable resources, large transcontinental pipelines and large power transmission lines. I have been involved in many of those, which were strongly criticized; many groups were opposed to their development. Oil sands raised concerns right at the beginning because the oil extracting process, as I said, was developed on an "as we go" basis; that technology compared to what is used today is very, very different.

Then the shales triggered a real revolution. Large proven gas reserves were found and developed in the US. As you have heard, the associated fracking technology was a source of environmental concern and of many disputes. That triggered government surveillance programs which showed very little—if any—water contamination that could be associated with fracking. Therefore, development continued in most states, excluding some states in Canada, namely Quebec.

The price of gas went down. Before the revolution, the price of gas was around 10 dollars per Mcf; it even reached 12 per Mcf at its peak. It went down to 4 dollars per Mcf, one third of the European price and one fourth or one fifth of the Asian price.

That was bad news for Canadian natural gas exports to the US. They went down because they could produce more in

the US. That is why Canadian producers, with Asian investors, are looking to the Asian markets, as these are very much more lucrative markets. Some Malaysian and some Chinese investors invest in Canadian resources to export natural gas and oil to their own markets.

In the US, natural gas found its way to the power market through combined cycle generators. Power is then produced at five to six cents per kilowatt-hour. That is a low marginal cost. That is half the price we used to sell, when I was CEO of Hydro-Québec, in the New England market. It is very, very competitive.

So it is not only a matter of natural gas or oil being less costly. It is also a matter of power cost to be very low. Of course, it is good news for US power consumers. It is also good news for the environment because not only CO₂ emissions will be greatly reduced, but other pollutants that affected air quality in the surrounding areas will also be reduced. Local areas were large, pollutants could travel significant distances, reaching Montreal and New England from the center of the US.

The question is how long this will last. First, we have to consider that dry gas formations—formations that contain 99% gas—can only be economically produced with existing technologies at a cost ranging from US\$5 to 6 per Mcf. But the technology is improving. Fracking technology moves forward a lot; it is getting better and better. Nowadays there are people who claim that dry gas formations can be produced at very much less than 5.50 dollars per Mcf. It could perhaps reduce the cost to 4 dollars per Mcf.

Furthermore, wet gas formation producing at the same time as natural gas, ethane, butane and other liquids that are associated with natural gas formations produces gas at very, very low prices. In fact, natural gas in some cases becomes a by-product and it can be flared, production remaining competitive. That means gas can be produced at very, very low prices. That tells us 3 dollars per Mcf for natural gas in North America is not impossible. From what I know, most shale formations do have a portion that is wet gas. For example, the Montney in northern British Columbia and the Utica in Ohio or North Dakota are wet gas formations. They can be produce at very low cost; that will push the price down or maintain the actual price.

On the other hand, there could be additional demand. Natural gas could be used and transformed into diesel through existing technologies. Secondly, it can be exported to overseas markets. For instance, Canadians are certainly looking at building pipelines and harbor facilities to export natural gas to the Asian market and they do that, as I said before, in association with Chinese and Malaysian investors. Natural gas could also find its way into the transportation market in the US. LNG (liquid natural gas) could be used in moving trucks across North America and moving ships from North America. That of course would add to the demand and could affect the price.

It will take time before any of those factors really come into play and therefore I personally agree, with most observers, that low natural gas prices will be with us for a long time, at least 10 years and maybe as long as 20 years.

This competitiveness is leading to a process called “onshoring.” This means that industrial activities that were displaced overseas, such as “offshoring” to Asia or to somewhere else in the world because of higher costs in North America, are coming back to North America. That is certainly true for the petrochemical industry, as well as for the fertilizer industry. In fact, it could very well expand to all industrial sectors where the energy cost is significant, so that is a great advantage for North America at this time.

And the revolution goes on as it extends to oil. New technologies allow for much more oil to be produced in North America. The US, for instance, with an oil market equivalent to 20% of the world market—that is close to 18 million barrels a day—now produces 10 million barrels a day, and that figure increases. Over the last semester, it increased by 1 million barrels a day. That is a lot, and that is why the WTI price is 20% lower than the BRENT.

This is of course providing another economic advantage for North America as a whole. It could be troublesome for some Canadian projects, namely the Keystone projects, because if US domestic sources are found and if they increase production, there will be less interest in the US for Canadian oil. The Canadian answer to that, as you have seen in the press, is to build more transportation capacity to bring oil to Eastern Canada markets and maybe to export overseas from the east coast. That remains to be seen of course, but that is a real possibility.

In conclusion, I think all of that reinforces the idea we had during my days at the World Energy Council, namely that any energy industry has to satisfy what we called then our “four As” criteria. First, energy has to be available; second, accessible; third, never forget that, affordable; and, fourth, it also has to be acceptable. From what I said, I think we do not have much of a problem in North America as far as the first three As are concerned. Availability: there is a lot. Accessibility: the infrastructure already exists for the largest part that is needed. Affordability: the oil price is 20% below BRENT price and the natural gas price is at 4 dollars per Mcf, and marginal power cost is at five cents per kilowatt-hour. But acceptability is something else. I think North Americans, namely Canadians, have to work on acceptability, notably on improving regulation. That is a concern not only for pipelines and production, but it is also a concern for rail



transportation. As you may have seen, we had a disaster this year in Lac-Mégantic Quebec, a disaster associated with rail transportation of light oil produced from shales in North Dakota.

For oil sands, I think the technologies existing today are much better than what you have seen on television. What you've seen was filmed at the beginning as we were learning, and obviously we had to learn, and we did. The technologies are continually improving and I think they will continue to improve. Western Canadians will also have to communicate much better. This is something Canadians do realize, you can expect they will work on that. Thank you and excuse me for being a little bit too long.