

DEBATE

Donald Johnston, Chair of the McCall MacBain Foundation, Geneva, Switzerland

You referred in passing to carbon capture and storage, or sequestration as some call it. This has been talked about for many years; it has never been brought up to scale to my knowledge. The Americans have abandoned their major project in the Midwest, and there is a lot of it going on in Westborough, Saskatchewan and in the Sahara, but that was done in connection with oil recovery, there was an economic purpose for it, as I recall, and the numbers we have looked at in connection with this are very expensive. When you say something like that and put it on the table, it is a good idea, but how will that translate into action with the oil and gas companies, and more importantly, with the thermal plants that are using coal? It seems to me that this is absolutely critical in that area. There has to be CCS if we are to continue with fossil fuels.

Bertrand de la Noue, General Representative of Total in China

You are right to say that today carbon capture is more at a pilot phase than anything else. We have done pilots ourselves in France, and there have been pilots in the US and here and there, even in China, where I think is one place it is being done. However, in China there is the complexity that underground facilities are state secrets, and we have been looking at ways of working on carbon capture in China, but we do not have access to data, we do not have access to information, so we are extremely limited in that regard.

The real issues there will be for the coal business, as you mention, and today it is very expensive. Firstly, we need to master the technology through those pilots, and after that it will be achievable and done only when there is a price for carbon. The price of carbon will decide at some point whether we do carbon capture. People will not spend millions of dollars, if not billions, to do carbon capture if they do not have anything in exchange or if they are not compensated for the price of carbon, so that, at a certain point in time, will be the key. Carbon capture will be done when there is a price for carbon.

Richard Cooper, Professor of International Economics at Harvard University

I have heard it suggested, just as an economic and technical matter, that it is a lot easier to capture carbon in gas-fired plants than in coal-fired plants. Is that so? It suggests, if it is so, that the use of gas as a bridge, as you suggested, could be even longer than otherwise if in fact the best place to turn for carbon capture is gas-fired power plants. What can you tell us about gas versus coal?

Bertrand de la Noue, General Representative of Total in China

I am not an expert on that, so I cannot comment on whether it is cheaper for coal or for gas. One point is also important in that respect. When you develop a gas plant or a coal plant, it is important that it is carbon capture-ready, and that is something which could be implemented very quickly by legislation on the part of states, saying that a company has a plant and cannot do carbon capture today for technical reasons and for lots of cost reasons, but at least it should be carbon capture ready.

**Tatsuo Masuda, Professor, Nagoya University**

Regarding CCS, I am working in the World Economic Forum. I am a member of the Global Agenda Council on Decarbonising Energy, and I am in charge of the technology and governance of those systems. There is a light at the end of the tunnel regarding CCS. The first commercial CCS was installed in Canada at the end of this year, right next to a coal-fired power plant, and with subsidies from local and federal governments, they make money which they can return to the investors. The company is now thinking of building a second one, so with some nice support from local and federal governments, CCS may be the future, but there is a downside. There needs to be a good layer for CCS and saving money. Japan is very difficult in that regard. Some places are okay. CCS should not be transported long distances, because transportation costs a lot, so if it is onsite, with a good layer, and with some supportive measures from the public sector, we could make CCS commercial, even today. We would like to see more examples of this.

Richard Cooper, Professor of International Economics at Harvard University

My understanding is the same as Don's, which is that the carbon at the Saskatchewan plant, the one which is actually operating, has economic value because it is used for enhanced oil recovery, so you want to locate a coal-fired power plant near an oil well which can use the carbon dioxide. The question is whether you can make it economic where it does not sit on top of an oil well.

Anil Razdan, former Power Secretary of India

I was a member of the Carbon Sequestration Leadership Forum, and the basic issue, of course, is the presumption that sequestration is safe storage. Mr Masuda was saying that first you need to locate those sites from where it will not escape. Secondly, it consumes 25% more energy, so you actually end up using 25% more basic fuel, whether it is coal or even gas, to capture it. The practical solution, of course, could be carbon capture and utilisation, that is, enhanced oil recovery, or, probably in the longer term, carbon fixation, that if you can fix the carbon into some inert compound you can let that compound lie, rather than putting it in caverns.

However, on the pessimistic side, there is a strain of thought that CCS was pushed because some countries did not meet their Kyoto obligations, so they said they would continue emitting but would sequester it. Frankly, it has not really caught on except for some success, also, in the North Sea, again located close to oil exploration, and I think the Norwegians are also looking at it.

William Ramsay, Senior Advisor of the Center for Energy, Ifri

I have a couple of minor comments. You are right about the technology of extracting the carbon dioxide from flue gas, but gas is distributed around, it is not in 1,000-megawatt units, so you do not have the economics of being able to put it in there like you can with a coal plant. Another point is that the public has not been engaged on this issue of CCS yet either, and will soon be hearing stories about carbon dioxide escaping from lakes in the Cameroons and killing populations from 40 km around before we convince our populations to put gas under their cities.

Sverre Vedal, Professor, University of Washington (UW) School of Public Health

Another point that you brought up has to do with the perspective on wind, solar and hydro. The perspective that was aired was that it was a technological issue, a technical issue, that it was not ready yet because of storage issues and things like that. However, there is a different perspective on that, that it is not a technological issue at all but one of political will. My perspective on that is coloured by a presentation I heard earlier this year by Mark Jacobson from



Stanford and his engineering mill. What they have done is to assume that all the energy needs in the US setting could be met by wind, solar and hydro, and they went through a very detailed analysis, with every state, all the difficulties of financing, land use, the fact that some states do not have much solar or much wind, and how you actually integrate all of that.

The take-home message at the end of the day is that it is technologically feasible to supply all of the energy needs of the US based on solar, wind and hydro. I am not discounting political will and the ability to do that, as those are major hurdles, but that perspective does put it in a different place on the table. If your perspective is that it is a technical issue that has to wait, it gets moved off the table. It is not part of the discussion we have been having. That is the importance of having a somewhat different perspective on those energy technologies.

Richard Cooper, Professor of International Economics at Harvard University

How did this Stanford study deal with the storage issue, the fact that there is wind in North Dakota that comes at the wrong time for New York?

Sverre Vedal, Professor, University of Washington (UW) School of Public Health

I am not the person to ask that, but at the end of the day I was convinced that they could do that, integrating those three sources of energy, hydro, wind and solar. Clearly the storage issue is a problem, but they faced it directly in their scenario.

Richard Cooper, Professor of International Economics at Harvard University

This is country-specific. A physicist at Cambridge called John MacKay did a comparable study for the UK just from physics point of view, not taking economics into account at all, and he concluded that the only way the UK could satisfy UK demand for power without fossil fuels was with nuclear energy. All the possible wind onshore and offshore, and all the possible solar, cannot physically, leaving aside the economics, meet Britain's power demand without nuclear, which has the densest power per square metre of land.

Bertrand Collomb, Honorary Chairman of Lafarge

We were talking about the price of carbon, and there have been wide-ranging estimates about what price of carbon would move things. There was a study by Mackenzie some time ago which said that a lot of things could be done at price zero because there was inertia in terms of financing issues, and that at a cost of USD30 or USD40 even more things could move. We heard that Total is taking USD35 dollars a tonne in its internal calculations, and we know that the European system, which was very much flawed from the beginning, is now giving USD5 or less. We also know that some of the subsidy systems for renewables in Europe, especially in Germany, amount implicitly to a price of carbon as high as USD250 or USD400 a tonne. I would be interested to know your idea, which can only be a guess, about what price of carbon would really move things in ten or 15 years' time.

Richard Cooper, Professor of International Economics at Harvard University

I can report on one experiment in British Columbia, which already introduced a price on greenhouse gas emissions, not just carbon, six or seven years ago. It started low, at CAD5 a tonne and ramped up to CAD30 a tonne, where it has



been for three years now. The preliminary indications are that it has been quite effective, that compared with other parts of Canada, British Columbia has significantly reduced carbon emissions without reducing growth in any way. You have to allow for the fact that British Columbia is not a big user of coal and has a lot of hydropower, so most of the impact of the price of carbon there is actually on the transport sector, home heating and things like that. Because of hydropower, the power sector, which is very big in many other countries, does not play an important role in demand for fossil fuels. But it is a very positive experiment run by one Canadian province.

Luigi Colantuoni, Group Representative of Total in Japan and South Korea

I have one comment about the carbon tax. The introduction of a carbon tax in some regions would definitely have an impact on the competitiveness of their industry. As an example, if a tax of EUR 40 per tonne of carbon dioxide would be introduced in Europe, the refining sector, which is already suffering with a refining margin of about 15 USD, would have an additional burden of another 2 USD, thus affecting further the future of this industry in the region. Therefore, unless there is a joint effort to introduce a carbon tax which considers the impact on worldwide competitiveness and employment in the long term, regional economies can be severely affected. Is it possible to have a global initiative on the introduction of a carbon tax without favouring industries in one region and penalising jobs, growth in other regions? This should be considered.

Bertrand Collomb, Honorary Chairman of Lafarge

I was not talking about a unilateral European carbon tax; I was just asking the academic question of how much would be needed to meet the objectives, and of course it has to be, if not universal, at least more or less distributed.

Richard Cooper, Professor of International Economics at Harvard University

This is the direction the COP should go if it wants to have a successful outcome, to switch from quantitative targets to prices and make it as universal as possible. Universal does not have to mean literally universal - 30 or 40 countries could start and then others could come in.

Luigi Colantuoni, Group Representative of Total in Japan and South Korea

Almost everyone is aware of the German paradox. Coal became cheaper and gas-fired power plants were shut down. The result has been that CO₂ emissions in Germany rose, in spite of the incentives given for the development of renewable energies. This is a clear consequence of not having a consistent policy to reduce emissions.

Marie-Claire Aoun, Director, Center for Energy, Ifri

I just have a quick question. You mentioned, Mr de la Noue, that energy should be profitable. How do you see the impact of the decrease in oil prices on the competition between fossil fuels and renewables?

Bertrand de la Noue, General Representative of Total in China

Obviously, it is not good news for renewable energy. The only thing you can say is that this is probably a short-term issue, and being short-term is looking at the investment time for oil energy. These lower oil prices will probably last a



few years, because what will happen today is that investments will be cut on oil and gas, because at USD68 yesterday, projects are not profitable enough, so companies are going to stop investing. The natural trend in any oil and gas field is depletion; a field loses 5-6% production per year, so if you do not invest just to compensate for that you will have less production in a few years' time. All the numbers show that, in any case, with the demand from Asia, we will need more oil and gas in the future. The paradox is that low oil prices will defer investments and will rebound off oil and gas prices later on. Will it happen in one year or two?

There are plenty of very bright economists who are now forecasting that this drop in oil prices will stay like that forever. We do not think so. The view of our company has always been that oil prices will tend to rise in the long term. I am not saying there will not be hiccups like today. It is bad news for renewables today, but we should not stop investing in renewables and in innovation; in any case, they will have to be sustainable without subsidies, and that is the clear message. We just talked about CCS in Canada. This is subsidised. The problem is that, if you want a worldwide plan, whether for CCS or renewables, they have to stand alone without subsidies, because problems arise, and we have seen that in Europe over the past few years, with financial difficulties in Italy, Germany or France leading to cuts in the subsidies for renewables, and the market is crashing. That is a big issue.

Looking at China today, they have a very ambitious goal, which is to have 20% of their energy mix from renewables by 2030. This is an extremely high percentage, and they will need a lot of investments. They will probably reach it, but to achieve that, it also has to provoke a change in the pricing of energy in China, because without it they will not reach that number.

Richard Cooper, Professor of International Economics at Harvard University

Let me move to the second session and to Christian, who will talk about the health implications of all of this.