

## DEBAT

### **Tatsuo Masuda, professeur, Nagoya University**

I have a very simple question for Christian. The number of deaths caused by air pollution were much lower than for other causes, but there is talk about air pollution killing many more people in China and New Delhi as well. Why is air pollution not the number one cause of death?

### **Christian Bréchet, directeur général, Institut Pasteur**

I just showed the results from the last IPCC panel. However, your point is well taken. Air pollution is a major concern at several levels; it will obviously increase the rates of some chronic diseases, such as cancers and many others, which is why we are very much afraid of this. Secondly, an underappreciated problem is that air pollution and a number of compounds will also impact on the vector-pathogen host interactions. There are some very interesting studies in French Guiana on how some chemicals might in fact not only impact the resistance to some mosquitos and their eradication, but also impact on the capacity of the virus to multiply within the mosquitos. I would not like to leave you with the impression that air pollution is less important; it is one of the major components, but I believe that we lack a lot of information on how it really acts on health.

### **Sverre Vedal, professeur, université de Washington (UW) School of Public Health**

The latest version of the Global Burden of Disease in 2012 tried to address those very issues about ranking risk factors for disability and mortality across the globe, and air pollution ranks about fourth in the developing world, where air pollution is much more of a problem than in the developed world. It ranks behind hypertension, diet and cigarette smoking, and so is in the mix of large risk factors.

### **Anil Razdan, ancien ministre de l'Energie de l'Inde**

I wanted to check on your reaction to CNG as a transportation fuel, because what I find is that increasing urbanisation, particularly in developing countries, leads to tremendous increases in particulate matter, and seven out of the ten worst polluted cities are in developing Asia, in terms of atmospheric pollution. However, there is a great shift towards CNG buses, for example, and Delhi probably has the largest fleet of CNG buses, but there is some debate on whether this is the right way to go about it, whether to go for electric transportation or CNG, because there are conflicting reports that benzene levels are higher with CNG. I just want to get your reaction.

### **Sverre Vedal, professeur, université de Washington (UW) School of Public Health**

It is another example that I could have included in the trade-offs issue that has either a win-lose or a lose-win type of scenario. The CNG will increase nitrogen oxide emissions, which could have a benefit, if you emphasise the fact that that forms nitrate particles in the long run, which are cooling particles. However, balanced against that, it is also a precursor for ozone formation, which is a warming agent, and so it boils down to how you weight those and what the



impact of those two are. Certainly, the reduction in particulate concentrations is important, so the primary particle emissions from CNG are much less than for the other fuels that we are using, and to the extent that those particles are warming - which some are not, but are cooling instead - that would be a major benefit. Therefore, the answer is complex, there are trade-offs to it, and there has been work trying to balance those trade-offs. Some of them are unacceptable from an air pollution perspective, which is trying to jack up cooling particles in some way while actually degrading our environment but actually being beneficial from a climate change perspective. The answer to your question is complicated.

**Richard Cooper, professeur d'économie à l'université d'Harvard**

What is your bottom line? Compressed natural gas, as I understand it, is substituting for diesel, and once you quantify all the pluses and minuses, surely there is a way to say whether it is better than diesel or not.

**Sverre Vedal, professeur, université de Washington (UW) School of Public Health**

The big issue is elemental carbon, or black carbon.

**Richard Cooper, professeur d'économie à l'université d'Harvard**

That comes from diesel fuel, particularly with badly maintained engines.

**Sverre Vedal, professeur, université de Washington (UW) School of Public Health**

Yes. The bottom line is that the reduction in particles, black carbon in particular, is a major advantage to compressed natural gas.

**Anil Razdan, ancien ministre de l'Energie de l'Inde**

You did not mention that there have been a lot of fires in badly maintained CNG systems in transportation vehicles, and there have been quite a few deaths.

**William Ramsay, conseiller du centre Energie, Ifri**

I have a question about the adaptability of bugs. Is any work underway to block the passage of pathogens through the vectors?

**Christian Bréchet, directeur général, Institut Pasteur**

Yes, there are many studies on this, and it is an emerging field. You can use a number of tricks, which I do not have time to detail, but there is a lot of work on this.

**Donald Johnston, président de la Fondation McCall MacBain**

You referred to geoengineering in your remarks, and you talked about the cooling pollutants, one of which was sulphate. One of the geoengineering proposals is to seed the atmosphere with these reflective pollutants, which would change the albedo. Is that what happens when you have a cooling pollutant? I did not quite understand how they cool, unless they are reflective.

**Sverre Vedal, professeur, université de Washington (UW) School of Public Health**

The primary mechanism is to scatter incoming radiation, so there is less incoming radiation to the earth and so less warming radiation emitted from the earth. Less radiation reaches the earth, so it is less warming; it just scatters the incoming radiation.

**Donald Johnston, président de la Fondation McCall MacBain**

Is it related to the geoengineering notion that we are talking about? The Chairman made reference to this, and there are several geoengineering projects out there, but that is one of them.

**Sverre Vedal, professeur, université de Washington (UW) School of Public Health**

It is not one that one should necessarily scoff at, because we have an historical example of what happened from the 1950s to the 1980s, where for example there was no sulphur control in the US, and warming did not increase as steeply until sulphur control was instituted in the early 1980s, as a result of this removal of cooling particles. Therefore, there is an historical evidence base that this actually does take place. It is just unpalatable. I come from the air pollution field, and to encourage some type of air pollution, to increase concentrations of air pollutants for perhaps a greater good, is initially unpalatable, but there is rationale for it.

**Donald Johnston, président de la Fondation McCall MacBain**

You have an expert at Harvard, David Keith, who is an enthusiastic supporter of this. That is where we get this gridlock which we seem to have, and we have to find some escape hatch.

**Richard Cooper, professeur d'économie à l'université d'Harvard**

Let me explain about Keith. He is actually not in favour of geoengineering, but is in favour of studying geoengineering. His basic view is that climate change may come faster or more abruptly than any of the linear models now show, and humanity may be caught off guard and needs to be prepared to deal with that. There are several different proposals out there, and his basic view is that we ought to understand them, whether they work, and what their side effects are, so that we make our decisions on an informed basis. He is not prepared at this stage to recommend geoengineering.

**Donald Johnston, président de la Fondation McCall MacBain**

I realise that; I did not want to attribute that to him. However, it is basically the fire extinguisher.

**Richard Cooper, professeur d'économie à l'université d'Harvard**

It is a Plan B.

**Wu Jianmin, vice-président exécutif du China Institute for Innovation and Development Strategy**

I have two questions for the President of the Institut Pasteur. Smoke is a major issue facing China. Last August, I took a high-speed train from Beijing to Wuhan, and there was heavy smog when I left Beijing. The train runs at 300 km an hour and runs for three hours; I saw only smog. Only when we entered Hubei did the smog disappear. Scientists in China are divided about what really forms the smog. Some people blame climate change, and others say it is too much burning of fossil fuels. What is your analysis? That is the first question.

Secondly, quite a few people in China have forecast that there will be an explosion of lung cancers in Beijing in six or seven years. What is your answer to this worry?

**Christian Bréchet, directeur général, Institut Pasteur**

Thank you for very easy questions. Regarding the first question, I am not an expert, but very simply, I would feel that both are hypotheses. I am not the expert to address this. I come quite frequently to China, where we have two institutes, and I believe that this is something that scientists are having difficulty answering precisely. I really believe that you have both factors, but it is a very vague answer.

Regarding the second point, you have in China what I tried to convey, a mixed bag between environmental factors, such as tobacco smoking, pollution, and infectious pathogens. You have a burden of hepatitis-related liver cancer, of papillomavirus-related cancer, and you have gastric cancer which is at the forefront of cancer cases, and which is related to bacteria. Then you have smoking and lung cancer. Therefore, yes, lung cancer will be at the forefront of the leading causes of cancer in China in the next few years, and this has already started, unfortunately. We can make the prediction that lung cancer, which is already very prevalent in China, will be at the forefront of cancers for the reasons you have presented.

**Bertrand de la Noue, représentant de Total en Chine**

Thank you for your encouraging words for people living in China. I have a very simple question for Mr Vedal. You spoke about cooling and warming particles. How do they compare to each other in terms of degrees, and can they cancel each other, or are we not talking about the same scale?

**Sverre Vedal, professeur, université de Washington (UW) School of Public Health**

They are on the same scale, and there has been a lot of work comparing the relative radiative forcings in total, and subtracting the warming effect from the cooling effect, etc., and the bottom line is that there is perhaps a somewhat greater warming effect, but the cooling effect is substantial, and it depends a little on region. It varies from region to region to some extent, and in some regions the cooling effect dominates, and in fact you have an overall air pollution



cooling effect rather than an overall air pollution warming effect. However, taken on average, there is a slightly greater warming effect from air pollution in total.

**Richard Cooper, professeur d'économie à l'université d'Harvard**

We will move on to the third session.