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Mercedes Maroto-Valer, director of CICCS

"We need more than clean technologies to combat climate change"

Mercedes Maroto-Valer, director of the Centre for Innovation in Carbon Capture and Storage (CICCS), visited the MatGas installations last April to participate in a seminar on Carbon Capture and Storage, organised by the research centre of the UAB Research Park. A research collaboration agreement between CICCS and MatGas was also established during her visit. In the following interview, Mercedes Maroto-Valer outlines the current state of the research in these technologies and reflects on the necessity to explain them to the community and assess the consequences of not implementing them in the near term.

The Spanish resarcher Mercedes Maroto-Valer is the director of the Centre for Innovation in Carbon Capture and Storage (CICCS) and deputy head of School of Chemical and Environmental Engineering of the Nottingham University. Her research interests are widespread and encompass several fields related to the environment and energy, with particular emphasis on carbon management, including CO2 capture and sequestration; recovery and utilization of combustion by-products; mercury control technologies; and coal carbonization. She has over 180 publications, holds numerous prestigious international prizes and leading positions in professional societies, editorial boards and acts regularly as reviewer for journals and funding agencies.

- Are CCS technologies the solution to climate change?

- Yes, I am sure they are. There are other measures for combating climate change. We can build wind turbines and hydroelectric plants and change our daily habits, but these solutions, although they help, won't solve the problem, because the magnitude of CO2 emissions cannot be countered only with clean technologies. In Spain, for example, more than 80% of our energy comes from petroleum, natural gas and carbon. We won't suddenly stop using these and be able to supply all our energy needs with renewable technologies, which currently make up only 10% of the total. What really provides us with the solution we need is Carbon Capture and Storage; we cannot afford not to develop this system.

- So, first we need to capture the CO2?

- Yes. CO2 emissions are captured directly from the industrial processes that produce them. They are captured mainly from electric power plants because these are fixed points that emit CO2 in great quantities and we are already working with them. CO2 can also be captured from cement plants or chemical industries, even though in the second case the CO2 can be reused to form other products.

- And once it's captured what do we do with it?

- Currently the most developed option is to store it permanently in underground deposits, even though finding appropriate areas for this isn't simple because these deposits have to have specific geographic characteristics so that CO2 will not leak into the atmosphere. Pipelines are also necessary to transport the CO2 safely, such as gasducts, which, although there are various projects currently underway, have not been created yet. In Europe for example these pipes would cross several countries and head towards the North Sea.

- Why the North Sea?

- This area has the best storage conditions. It produces a large amount of gas and the Nordic countries have been studying the geologic formations for many years now. We know that it is possible to store carbon there. At the moment only Norway is storing carbon dioxide. They separate it from the rest of the gases that form natural gas and inject it into the geological surface. So they don't have to build pipelines. These conditions are simpler than when we have to work with power plants and pipes.

- What other systems are being researched?

- One of the most promising, which could be the perfect solution to our problems, is converting CO2 into methane, which is the main component of natural gas. We are researching this technology with the MatGas researchers. It is an artificial process similar to plant photosynthesis, which uses water, light and CO2 to produce carbohydrates. Biologists and chemical engineers are developing a process that mixes these three elements with catalysts to obtain methane.

When you use methane it produces CO_2, which can be captured to produce natural gas again. So we obtain a perfect, closed energy cycle.
We are also researching converting CO_2 into building minerals. In this case, CO_2 reacts with other gases, water and silicon rocks to obtain carbonates. We can capture three litres of CO_2 in a stone the size of a domino. This material can be used to make bricks or additives to build roads. Nature also converts CO_2 from a gas to a solid, but at an infinitely slower rate than the industrial process we are investigating. We achieve in hours what naturally takes centuries.
This last process is valid but not on a general scale because in some cases we produce a lot more than we actually need. The best option is without doubt converting CO_2 into natural gas.

- In what stage is the research and commercialisation of the process?

- Currently, none of these systems is really available to be commercialised. That's why research centres such as CICCS and MatGas are working with scientists, engineers and companies to speed up development and implementation and start to commercialise these processes as soon as possible. Depending on the intensity of the research, which requires an appropriate economic investment, we could be up and running within five years. However, not all of the technologies are developed to the same level of commercialisation. The storage process could be developed the quickest and the other two processes will take more time.

- What would be the implementation costs?

- There is no doubt that these processes are expensive, but we have to realise that if we don't act quickly the costs will be a lot higher. According to the Stern Report, which was published at the end of 2006 and is the most important economic study carried out on CO_2 emissions and the greenhouse effect, developed countries would currently have to invest 1% of the GDP if we want the CO_2 emissions to stop increasing. This figure is very low if we compare it with the 20% we will have to invest within a decade.

- What is Spain's position on CCS technologies?

- As I mentioned before, the geologic deposits are mainly found around the North Sea, between northeast Scotland and Norway. Spain is a long way away from this area. The possible pipeline would start in Tarragona, go through France and then up to the North Sea. But Spain has to consider other processes as priorities. The best option would be to invest in processes that convert CO_2 into gas and rocks. That is why it's important to develop different technologies to cover the economic and geographic needs and conditions of all the countries and types of industries.

- What about an emerging country like China, which is a huge CO_2 emitter?

- China is growing very quickly. Every 10 months it builds as many power plants as there are in the entire United Kingdom. It emits a huge amount of CO_2 and in the future it will need CCS technologies more than Europe. This will allow the countries that develop these technologies to commercialise them in emerging countries.

- How are these technologies being explained to society?

- CICCS works with sociologist to study public opinion and organise information seminars. We have found that people are fairly reticent about the pipeline for transporting the CO2 being built near their homes. So we explain that the systems being developed are very safe and also go into detail about the risks of a CO2 leak. But, above all, we explain that the problem of carbon dioxide emissions needs quick action, which involves using these technologies.

- What are the risks of a CO2 leak?

- Firstly, a leak would mean that we are unable to combat the greenhouse effect, as the gas would be re-emitted into the atmosphere. There could be health and environmental consequences if all the CO2 stored was in the same deposit, which is unlikely, and it all re-emerged at the same time. It is more likely that there are very small leaks from a surface that has been injected with CO2, perhaps less than 1% in fairly large surfaces. The worst situation would be that in 100 years time all the stored CO2 was re-emitted into the atmosphere. That is why we need to progress and improve the research we are currently carrying out.

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