# ExxonMobil: Carbon capture is critical to attaining society's emission-reduction goals

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Few challenges are more important than meeting the world's growing demand for energy while reducing environmental impacts, including the risks of climate change. ExxonMobil believes carbon capture and storage is an essential technology to help meet this dual challenge, because it is one of the few proven technologies that could enable some sectors to decarbonize, such as manufacturing and heavy industry.
ExxonMobil has more than 30 years of experience with CCS technology, including the design, construction and safe operation of carbon capture and storage facilities around the world. Additional opportunities are under evaluation, and they all have the potential to move forward with current technologies, provided stable, supportive policies and regulatory frameworks are established.

The energy-intensive industry and power generation sectors are essential for modern life. They produce electricity to power our homes and workplaces. They provide fuels and lubricants for transportation, cement and steel for construction, and the building blocks for a range of important products, from medical supplies to lightweight materials for cars to food packaging.

They also produce carbon dioxide, accounting for nearly two-thirds of the world's energy-related $CO_2$ emissions, according to the International Energy Agency. Every ton of cement that's produced emits an equal amount of carbon dioxide, for example, and every ton of steel produced emits almost double the amount of $CO_2$. The associated industrial processes make them among the hardest sectors to try to decarbonize.

Enabling these sectors to continue making the products a growing world population needs, while also preventing the $CO_2$ from reaching the atmosphere, would go a long way toward meeting the climate goals outlined in the Paris Agreement – A pact ExxonMobil has supported since its inception.

ExxonMobil's Low Carbon Solutions business is working to build upon its leading position in carbon capture and storage, and scale it up to address emissions in these two sectors. We believe we have the capability to do so because of our ability to execute large, complex projects; our experience capturing, transporting and storing $CO_2$; our knowledge of reservoir and subsurface characteristics; and our expansive research portfolio in this field.

As president of Low Carbon Solutions, my job is to lead ExxonMobil in applying that expertise to bring the most promising carbon capture and storage innovations to scale. In less than a year, we've made significant progress.

Shortly after its launch in early 2021, Low Carbon Solutions proposed a carbon capture and storage initiative in Houston, Texas, that could capture and permanently store about 100 million tonnes of $CO_2$ annually by 2040. To put that number into context, capturing and storing 100 million tonnes of $CO_2$ is equivalent to removing more than 20 million cars from the road.

That concept moved forward in September when 11 companies, including ExxonMobil, announced their support for the large-scale deployment of carbon capture and storage technology in the Houston industrial area.

Houston is an ideal spot, being home to one of the world's most significant industrial corridors and located just off the Gulf of Mexico and its underground geologic reservoirs that could hold 500 billion tonnes of $CO_2$, according to our analysis of US. Department of Energy estimates. That's enough storage capacity for more than 130 years of the total industrial and power generation emissions in the United States.

There are other excellent locations for carbon capture and storage throughout the world, so our efforts go beyond Houston. Here's what we're doing:

- in the second quarter of 2021, Low Carbon Solutions signed two memorandums of understanding to progress carbon capture and storage projects in Scotland and France. We then expanded our participation in the Acorn project in Scotland by signing an Expression of Interest to add our Fife Ethylene Plant to the project;

- in September, we signed an MOU with Rosneft to assess the potential of lower-carbon technologies to reduce greenhouse gas emissions in Russia, with the intent to jointly develop and implement lower-carbon projects;
- and, in 2022, we anticipate final investment decision for a carbon-capture expansion at our LaBarge facility in Wyoming, United States, and a carbon capture tecnology pilot associated with the Porthos carbon capture and storage project in Rotterdam. Porthos itself also expects a final investment decision in 2022.

ExxonMobil has long emphasized research and development, and our scientists are working with independent specialists and national laboratories on innovations that could one day offer new commercial solutions. Direct air capture is promising. So are carbonate fuel cells and metal-organic frameworks, which can capture emissions from power plant or factory exhaust. And when coupled with carbon capture and storage, low-carbon hydrogen is likely to play a critical role. All are part of our longer-term research into fundamental science to support lower-emission technologies.

Carbon capture and storage is a technology that exists today, and we've captured more human-made $CO_2$ than anyone else, which is why it is the initial focus of our Low Carbon Solutions business. It is an essential technology in achieving society's net-zero goals:

- the International Energy Agency's (IEA) executive director says it would be "virtually impossible" to reach net-zero emissions without carbon capture and storage operating at scale;
- the IEA's Net Zero Emissions scenario shows carbon capture and storage playing a major role, capturing 5 billion metric tons of $CO_2$ from power generation and industrial processes by 2050. That's 50 projects equivalent to the projected size of what's being proposed for Houston;
- the United Nations Intergovernmental Panel on Climate Change (IPCC) estimates that global decarbonization efforts could be twice as costly without carbon capture and storage.

Supplying the world with the affordable, reliable energy and products it needs while also advancing lower-carbon options requires "an all-of-the-above approach" that includes renewables, low-carbon hydrogen, lower-emission biofuels and carbon capture and storage.

With the right policy support and the need to reduce $CO_2$ emissions for industrial processes, carbon capture and storage technology is poised for tremendous growth – two of the same factors that helped create the rapid expansion of wind and solar power over the past two decades. According to our analysis of IPCC data, the total addressable global market for carbon capture and storage could reach $2 trillion by 2040, equating to growth of more than 30% a year.

Although the world will need additional solutions to ultimately reach a net-zero future, carbon capture and storage is here now, capturing millions of metric tons of $CO_2$ every year. Scaling it up would help turn those millions into billions, enough to make a significant impact on emissions at a lower cost to society. The key to scaling it up is effective policy to enable additional public and private investment.

For us, effective policy starts with the need to establish a market price for carbon emissions and to make that price as universal as possible, regardless of which technology is used to capture them.

A transparent carbon price would be effective for a few important reasons: It would enable people and businesses to make more informed decisions; create a strong incentive for companies to operate more efficiently; reduce relative demand for high-emissions goods and services by increasing their costs; and encourage investments in proven technologies like solar, wind and carbon capture and storage without favoring any one technology over another.

Significant investments will be needed to grow carbon capture and storage capacity. A system of the size we envision for Houston will require installing $CO_2$ collection equipment at multiple industrial sites, constructing pipelines to move the $CO_2$ to a storage location, and drilling injection wells deep into the subsurface for secure long-term storage.

So far, carbon pricing is a patchwork that covers only some parts of the globe. Systems in the European Union and North America use cap-and-trade markets. In Australia, the government has employed an effective reverse auction system to encourage the supply of low-emission energy. And much of the world, particularly in developing countries, doesn't have any form of carbon pricing.

ExxonMobil supports harmonizing systems across countries. Emissions are emissions, regardless of where they originate. Nations with carbon pricing may have to enact border carbon adjustments on imports to prevent foreign producers from gaining an unfair advantage or ignoring emissions-reduction goals altogether. Nations without carbon pricing should consider exploring the concept, provided they have the capacity to do so, and it's not at the expense of providing reliable, affordable energy to their own citizens. Effective carbon policies in developing nations will be critical.

Governments will have the further decision of how to manage the revenue the new markets create. Two productive possibilities would be to recycle that money as direct payments to households as a "carbon dividend" or invest it in promising technologies.

New technology and infrastructure will also depend on supportive policies, stable regulatory frameworks and sustained long-term government support for research and development. Carbon capture and storage technology requires significant investment – the 100 million tonnes Houston idea is expected to cost upwards of $100 billion, for example. So government support will be critical.

Some examples of that support include durable incentives that can be provided through a variety of mechanisms, such as grants, tax credits or low-interest loans. Others are as simple as extending the amount of time available to take advantage of an existing credit.

The potential benefits of developing an effective low-carbon marketplace are numerous. As more investment comes to the market, competition increases and products get better and cheaper. That improved efficiency means more users can find profitable ways to use the product, increasing the size of the market and attracting even more investment. It's a virtuous cycle. We've seen it with solar. We've seen it with batteries. We've seen it with wind. With proper support, we can see it with carbon capture and storage as well.

ExxonMobil is committed to playing a significant role in advancing a lower-carbon energy future. We are working to reduce emissions in our own operations, and we're developing and deploying solutions that can be scaled up to make up a significant difference in the energy transition. Carbon capture and storage is going to play a critical role for the world and our company. We're excited about its potential.