

ExxonMobil Low-Emission Research Communications Plan 2016

Background (For Internal Use)

- ExxonMobil is researching a number of technologies to advance low-emission energy production and increase efficiency and emissions reductions at company facilities.
- Effectively highlighting ExxonMobil's commitment to fundamental science and the breadth of research programs in various states of review and completion will position ExxonMobil as a constructive participant in efforts to meet energy needs while managing the risks of climate change.

Strategies / Tactics (For Internal Use)

- Targeted media outreach to increase understanding of ExxonMobil's research and collaborative efforts with third parties.
 - Provide New York Times reporter John Schwartz with a tour of the Clinton N.J. research facility, to be led by Vijay Swarup, EMRE vice president of research and development.
 - The tour and briefing will be on background followed by an on-the-record interview. Timing: early March.
 - Key objectives are to provide Schwartz with an understanding of ExxonMobil's research approach and suite of research projects, and to pre-position him for a potential interview on the fuel cell carbon capture project when appropriate.
 - Schwartz was chosen for his balanced reporting style and science-focused reporting beat on the intersection of energy and environmental policy.

Key Messages (For External Use)

- ExxonMobil is one of the world's leading companies in researching and developing solutions to the dual challenge of meeting the world's energy needs and reducing the environmental impacts of energy use.
- ExxonMobil conducts cutting-edge research and development through a combination of efforts within the company, in collaboration with industry partners, and through sponsored research at academic and nongovernmental institutions. These emerging energy research areas includes biofuels, carbon capture and storage, bio-products, non-hydrocarbon energy supply, power generation, transportation, energy efficiency and climate science
- In addition to ExxonMobil's in-house R&D programs, we partner with an array of universities and research institutions worldwide to advance the search for solutions.
 - We are a founding sponsor of the Global Climate and Energy Project based at Stanford. And have maintained our membership for the past XX years
 - We have recently begun a series of collaborative research initiatives at MIT, Princeton and other leading universities to explore the further potential of biofuels, carbon capture and storage and other promising technologies.
- We employ approximately 18,000 scientists and engineers (I thought the number was 20,000) and invest about \$1 billion annually in research and development.
- Throughout our more than 100-year history, ExxonMobil scientists have been at the forefront of innovation enabling discoveries and inventions that have resulted in thousands of patents and redefined how the world is powered. Mobil 1, for example, is the world's first synthetic motor oil, and the rechargeable lithium ion battery developed by an Exxon researcher makes the concept of an electrical vehicle possible. In the 1970s, Exxon subsidiary, Solar Power Corporation, and Exxon's Linden New Jersey Lab were instrumental in dramatically reducing the cost of solar cells, so that this technology which was until then almost exclusively used for space applications, suddenly became accessible for terrestrial uses.
- Approach to research

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- When it comes to R&D, as well as every aspect of our capital-intensive business, ExxonMobil takes a long-term and disciplined view.
- We have institutionalized this long-term view through an internal initiative we call ExxonMobil Emerging Technologies program. The program brings together scientists, engineers and executives from across our many business lines to evaluate technology-research opportunities from the perspective of what we will require 20, 30 or even 50 years into the future – not just what we require day-to-day or quarter-to-quarter.
- Generally, our research falls into five broad categories: expanding supplies, increasing access to energy, improving energy efficiency, mitigating environmental impacts and promoting good science for sound policy.
- We apply the discipline of several “review gates” that test whether the technology is safe, practical, reliable, affordable, sustainable and scalable. Less promising leads are abandoned so that efforts can be more effectively directed to the more likely options.
- Scale is especially important. Many technologies look promising, but they need to be able to be produced in sufficient quantities to meet global energy needs and reduce global environmental impacts.
- Our approach is not only long-term – it is wide-open. ExxonMobil’s work covers every aspect of the energy business, from oil and natural gas to alternative energy, and explores areas outside the company’s current business focus.
- If a technology could have a material effect on the future of energy, we will understand and evaluate it. For example, the company invested early in solar and nuclear energy research. The first rechargeable lithium-ion battery, a technology that now powers consumer electronics and today’s electric vehicles, was developed in the 1970s at an Exxon laboratory.
- *Corporate Strategic Research Laboratory*
 - At the center of our research is ExxonMobil’s Corporate Strategic Research laboratory, located in Clinton, N.J. It is a fundamental research institution, with approximately 150 Ph.D. scientists and engineers focused on addressing the company’s long-range science needs.
 - The laboratory’s scientists are internationally recognized experts in their fields. Our research portfolio includes a broad array of programs, including environmental life-cycle assessment, biofuels, carbon capture and sequestration, alternative energy, advanced fuels and internal combustion engines, climate science and materials science.
 - The Clinton, N.J. research center was designed with a science focus and located separate from our various business lines to maintain a disciplined focus on long-term research without business distractions. We are unique in the energy industry as we are the only company with a fundamental science based research lab.

Emissions Reduction Initiatives

- *Advanced Biofuels Research Program*
 - ExxonMobil is pursuing research in a broad array of advanced biofuels options, including basic science research to develop algae biofuels with Synthetic Genomics, Inc. This includes research into synthetic algae strains. Growing algae to expand sources of transportation fuels would actually consume carbon dioxide rather than produce it, and algae growth does not require valuable crop land for cultivation like corn-based ethanol does. The algae biofuels program is expected to be a long-term endeavor.
 - ExxonMobil is also exploring a variety of biomass conversion processes that could be used with non-food based feedstocks such as whole cellulosic biomass, algae feedstocks and cellulose-derived sugars. These programs are being carried out currently with Iowa State University and Northwestern University. The purpose of these research and development programs is to explore new technologies and seek the best pathways toward scalable and cost-effective production of advanced biofuels.
 - ExxonMobil and Michigan State University have begun a \$1 million relationship to expand research designed to progress the fundamental science required to advance algae-based fuels. The challenge is to find and develop algae that can produce bio-oils at scale on a cost-efficient basis.

- ExxonMobil announced an agreement with Renewable Energy Group, Inc. in January 2016 to study the production of biodiesel by fermenting renewable cellulosic sugars from sources such as agricultural waste. Renewable Energy Group has developed a patented technology that uses microbes to convert sugars to biodiesel in a one-step fermentation process similar to ethanol manufacturing. The research will focus on using sugars from non-food sources.
- *Cogeneration*
 - ExxonMobil is the world's leader in cogeneration, a technology that enables the simultaneous production of electricity and capture of heat to produce steam for manufacturing. Since 2004, we have invested more than \$1 billion in cogeneration, and we currently have interests in approximately 5,500 megawatts of cogeneration capacity in more than 100 individual installations at more than 30 locations around the world.
 - Through ongoing incorporation of cogeneration technology into its facilities, ExxonMobil is able to generate power more efficiently and with less environmental impact compared with purchasing electricity from a local utility. Cogeneration captures heat generated from the production of electricity to use in production, refining, and chemical processing operations.
- *University Partnerships*
 - ExxonMobil is a founding sponsor of Stanford University's Global Climate and Energy Project (GCEP), a long-term science and engineering research effort. GCEP conducts fundamental, pre-commercial research to lay the foundation for energy options that reduce greenhouse gas emissions. We have funded nearly \$83 million of research out of \$100 million pledged through this program in more than a decade of GCEP sponsorship.
 - In 2014, ExxonMobil joined the MIT Energy Initiative, a unique collaboration aimed at advancing and exploring the future of energy. As a founding member, ExxonMobil agreed to invest \$25 million during the next five years to support faculty and student research efforts. ExxonMobil will collaborate with MIT on a wide range of projects, including research to improve and expand renewable energy sources and find more efficient ways to produce and use hydrocarbon resources.
 - ExxonMobil has committed \$5 million over five years to join Princeton University's E-fuel Partnership to research ways to meet the world's energy needs in a sustainable way. The agreement demonstrates a resolve to explore a broad spectrum of ideas and approaches to address global energy needs and environmental concerns.
 - In the past decade, ExxonMobil has spent more than \$80 million on university partnerships. This should be a much higher number if GCEP is included (as noted above, it alone is \$83M)
- *Carbon Capture and Sequestration (CCS)*
 - ExxonMobil is a leader in one of the most important next-generation technologies: carbon capture and sequestration. CCS is the process by which carbon dioxide gas that would otherwise be released into the atmosphere is separated, compressed and injected into underground geologic formations for permanent storage.
 - The Intergovernmental Panel on Climate Change estimates that fossil fuel power plants and large industrial facilities account for as much as 60 percent of global carbon emissions. Thus, broad-based deployment of cost-effective carbon capture and sequestration has the potential to make a massive impact on the world's greenhouse gas levels.
 - Currently, making use of CCS to reduce significant amounts of emissions is prohibitively expensive. However, ExxonMobil uses the technology during enhanced oil recovery, injecting captured and compressed carbon dioxide into depleted oil wells to make them more productive. This experience, combined with ongoing research and sequestration partnerships means that CCS may well become a viable and important emissions reduction option in the near future in large part due to what ExxonMobil is doing today.
 - ExxonMobil has a working interest in more than one-third of the world's current carbon capture and sequestration capacity. We captured more than 6 million metric tons of carbon dioxide for sequestration in 2014 alone. This is the equivalent of eliminating the annual greenhouse gas

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emissions of more than 1 million passenger vehicles. The potential of this technology, however, is many times greater.

- *Role of Natural Gas*

- As the nation's leading producer of natural gas, ExxonMobil has played a major role in the overall drop in U.S. greenhouse gas emissions to levels not seen in decades. These are the sorts of investments and real-world technological advances that are making a significant difference today.
- The technologies pioneered by our industry have led to a recent revolution in natural gas production from shale in the United States, which has made the U.S. more competitive and more energy secure, and has also led to a reduction in CO₂ emissions to the lowest levels in decades.
- Natural gas emits up to 60 percent fewer emissions than the coal it is most often displacing for power generation. Hydraulic fracturing, coupled with horizontal drilling, is just one example of innovation resulting in emissions reductions within our core business.

- *Results of Low-Carbon and Efficiency Research Programs*

- Our research and development in reducing emissions and mitigating other environmental impacts has yielded some promising results so far.

➤ Can we have a lead bullet around the number of patents we have received over the past X years in the areas of low-carbon and efficiency? I think a good summary point in the results section

- For example, our Controlled Freeze Zone technology (CFZ), can separate CO₂ from natural gas streams. It essentially "freezes" the CO₂ in the natural gas into a solid, which enables separation. From there, the CO₂ can be reused or sequestered. This innovation could play an important role in making carbon capture and storage more widely available. We have invested more than \$100 million at one of our facilities in Wyoming to demonstrate this technology.
- Our programs focused on improving energy efficiency also have important benefits for emissions reduction. ExxonMobil has pioneered a suite of technologies designed to improve vehicle fuel economy that can not only save drivers in fuel costs, but also reduce emissions. These emissions-reducing vehicle technologies include lightweight plastic car parts, tire-lining technology that keeps tires properly inflated longer, and synthetic lubricants that improve engine efficiency.
- ExxonMobil conducts joint research with leading vehicle manufacturers on technologies to improve the fuel efficiency of cars and trucks and thus help reduce fuel use and emissions.
- Our research has also led us to develop an innovative on-board hydrogen-powered fuel cell system that converts conventional fuels into hydrogen for a fuel cell right under a vehicle's hood. This technology can be up to 80 percent more fuel efficient and emit up to 45 percent fewer CO₂ emissions than conventional internal combustion engines.

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