

Algae Biofuels Program Talking Points
Endorsed by MJD 07-10-09

Algae Biofuels Program Announcement

- ExxonMobil is launching a significant new program to research and develop next-generation biofuels from photosynthetic algae. This is part of ExxonMobil's ongoing commitment to advance breakthrough energy technologies to help address the world's long term energy challenges.
- Meeting the world's growing energy demands will require a multitude of technologies. Biofuels from algae could be a meaningful part of the solution in the future because of its potential as an economically viable, low net carbon emission transportation fuel.
- As part of the program, ExxonMobil Research and Engineering Company is teaming up with Synthetic Genomics, Inc (SGI) to develop, test, and produce biofuels from photosynthetic algae. Algae produce bio-oil that can be processed into biofuels similar in structure to today's gasoline and diesel fuels. This helps ensure the fuels are compatible with existing transportation technology and infrastructure.
- This alliance brings together two organizations, each with leadership and expertise in its field, to pursue a commercially viable solution to the significant energy challenges facing the world today:
 - SGI's expertise in genomics, metagenomics, synthetic genomics, and genome engineering; and
 - ExxonMobil's expertise in the manufacture of transportation fuels and the development of technologies and systems to increase the production scale from benchtop concepts to large-scale manufacturing
- Under the program, if research and development milestones are successfully met, ExxonMobil expects to spend more than \$600 million, which includes \$300 million in internal costs and potentially more than \$300 million to SGI.
- **ExxonMobil's analysis has concluded that final development and broad deployment of algae-based biofuels by the company would require future investments of billions of dollars.**
- The majority of the research work will take place in SGI's facilities located in La Jolla, CA. EMRE will conduct its research at its Clinton, NJ and Fairfax, VA facilities. The sites for scale-up activities will be determined at a later date.

- ExxonMobil has been engaged in a long term effort to examine the potential of next generation and renewable fuels. After considerable study, we have concluded that biofuels from photosynthetic algae have potential benefits and advantages.
 - Algae can be grown using land and water unsuitable for plant or food production, unlike some other first- and second-generation biofuel feedstocks.
 - Select species of algae produce bio-oils through the natural process of photosynthesis – requiring only sunlight, water and carbon dioxide.
 - Growing algae consume carbon dioxide; this provides greenhouse gas mitigation benefits.
 - Bio-oil produced by photosynthetic algae and the resultant biofuel will have molecular structures that are similar to the petroleum and refined products we use today.
 - Algae have the potential to yield greater volumes of biofuel per acre of production than other biofuel sources. Algae could yield more than 2000 gallons of fuel per acre per year of production. (Source: *Dr. John Benemann presentation at Seattle Microalgae Biomass Summit Oct. 2008 and EMRE biofuels strategy study. Based on gallons of gasoline equivalent energy*) Approximate yields for other fuel sources are far lower:
 - Palm - 650 gallons per acre per year
 - Sugar cane – 450 gallons per acre per year
 - Corn – 250 gallons per acre per year
 - Soy – 50 gallons per acre per year
 - (Current yields do not generate an economically viable product. This will require further modification of the algae strains to maximize their bio-oil production.)
 - Algae used to produce biofuels are highly productive. As a result, large quantities of algae can be grown quickly, and the process of testing different strains of algae for their fuel-making potential can proceed more rapidly than for other crops with longer life cycles.
 - If successful, bio-oils from photosynthetic algae could be used to manufacture a full range of fuels including gasoline, diesel fuel and jet fuel that meet the same specifications as today's products.

ExxonMobil's Spend Commitment

- ExxonMobil expects to spend over \$600 million, if milestones are successfully met over the next 10 years. This is based on our projections about the effort and resources needed to support the development of this technology in the coming years. But it is important to remember that this

is a research and development project that could return a variety of results that will influence the exact dollar amounts over time.

Project Potential and Risk Analysis

- Supplying the world with energy is a massive enterprise that requires enormous investments that carry inherently high financial risks. There are no guarantees of success in research projects like ExxonMobil's algae biofuels program, but only by taking financial risks can we achieve breakthroughs.
- **There are many questions that will need to be answered over the course of this long term research and development initiative. It is premature to speculate on details associated with fuel development and use at this early stage.**

SGI/BP Relationship

- ExxonMobil is aligning with SGI because of its reputation as a world leader in biology and genomics. Others have recognized the value of SGI's talents and experience as well, including BP which is engaged with SGI on a different kind of project and has an investment stake in SGI.
- SGI's relationship with BP will have no impact on EM's work with SGI to research and develop transportation fuel from photosynthetic algae. To ensure confidentiality, EM's agreement with SGI includes strict limitations on the information that BP or other SGI investors have access to regarding this new project. If our work proves successful, then everyone stands to gain, including investors in SGI, like BP.

Economic Development (Endorsed 8/3/09)

- ExxonMobil's algae biofuels research and development program is a long term effort that will develop over the course of the coming years and potentially decades.
- In the early stages of the program, the majority of the biology research and development work will take place at SGI's facilities in La Jolla, California. ExxonMobil will conduct its research at its existing facilities in Clinton, New Jersey and Fairfax, Virginia.
- All these facilities are home to significant intellectual and physical assets that will be critical to the entirety of the program, but particularly in the years to come during the early phases of research, development and demonstration.

- If the early phases of the program prove successful, there could be a need to utilize other existing assets or develop new facilities in the future. However, at this time it's too early to consider where any new facilities might be located or what criteria would be considered in making such decisions.

Genetically Modified Organisms

- ExxonMobil and SGI are committed to the responsible and safe use and management of any genetically modified organisms as part of the algae biofuels program. Throughout the project the companies will continue to explore ways to ensure that any genetically modified organism that is being used does not negatively impact the environment.

Energy Outlook

- It is important to recognize that major shifts in energy usage occur over multiple decades, not years. So while modern renewable fuels are growing rapidly, their relative share of the overall energy mix will remain low because they start from a small base. It takes decades to develop the technology and global infrastructure necessary for a fuel source to fundamentally alter the overall energy mix. (Source: *EM Energy Outlook*)
- In the years to come, oil and natural gas will continue supplying the majority of our energy because they are scalable, affordable and versatile. But alternatives and next-generation fuels - like algae - could play important roles. (Source: *OpEd July 23*)
- That is why ExxonMobil is pursuing a suite of integrated solutions to meet the world's energy challenges.

"Greenwashing" Perception

- EM is developing a variety of new technologies to help meet growing energy demands and reduce greenhouse gas emissions. We have said publicly that we would not commit significant resources to biofuels development until we believed there was a new technology that had real promise.
- After considerable study, we have concluded that biofuel from photosynthetic algae has the potential to be a commercially viable transportation fuel. We believe this potential warrants a significant investment in an aggressive research and development program. The anticipated level of investment and the engagement of SGI are indicators of how serious this project is for ExxonMobil.

EM Ongoing Technology Efforts

- Since 2004 we have invested more than \$1.5 billion in activities that reduce greenhouse gas emissions and improve energy efficiency, and we will spend at least \$500 million on additional initiatives over the next few years. Over the past several years, ExxonMobil has improved efficiency at a rate of about two to three times faster than the industry. (Source: *EM Corporate Citizenship Report, 2008*)
- Our strategy for alternatives and low-emissions energy technologies is two-fold:
 - First, we've developed a variety of technologies available today, such as tire liners that keep tires inflated longer, advanced fuel economy engine oil and light weight automobile plastics.
 - Secondly, we are working on other new technologies both for the mid and longer-term that address the need for both improved fuel economy and reduced emissions. For example:
 - We developed an improved lithium battery separator film that could help enable the next generation of hybrid electric cars
 - We are involved in advanced engine and fuel system research that could significantly improve fuel economy
 - We are researching a way to generate hydrogen on board vehicles to power fuel cells which could improve fuel economy by 80% and reduce emissions by 45%
 - We are investing more than \$100 million to develop and demonstrate a new technology (Controlled Freeze Zone) to separate CO₂ from natural gas and re-inject it into the ground. This new technology could allow us to develop some sources of natural gas at a lower cost and could make carbon capture and storage more affordable over time.
(Source: *EM CCR online*)
- While first generation biofuels such as corn-based ethanol are currently making a contribution to the energy mix, their net greenhouse-gas benefits have been called into question, and their impact on global food supply has raised concerns.

GCEP

- EM is engaged in numerous projects to meet the world's energy challenges and reduce greenhouse gas emissions.
- Two of these projects, the Global Climate and Energy Project (GCEP) at Stanford University which EM supports and EMRE's new strategic alliance with Synthetic Genomics, are aimed at producing transformational new energy technologies.
- Both projects are based on the principle that meeting the world's energy challenges requires the best and brightest minds from across sectors and disciplines.
- While they are based on similar principles, the focus and goals of the GCEP program and EMRE's work with SGI differ.
- GCEP is a long-term, collaborative research and development effort that brings together experts from private industry and academia, and provides funding on a competitive basis for projects that will advance fundamental, pre-commercial research on an array of promising technologies.
- Research projects supported by GCEP are focused on solar, biomass, hydrogen, CO₂ capture and storage, advanced batteries, fuel cells and energy efficiency, all of which have the potential to significantly reduce emissions associated with electricity generation and transportation. All of the GCEP programs are very long-term in their focus.
- EMRE's alliance with SGI is a new strategic joint development activity at ExxonMobil that is bringing together experts in energy, engineering and technology from ExxonMobil with the world's leading scientists in the field of genomics at SGI.
- The work initially being pursued by EMRE and SGI is focused on research, development and commercialization of transportation fuels produced from photosynthetic algae that could one day be widely produced and marketed.
- These complementary projects will help develop the diverse set of technologies that will be required to meet the world's growing energy and environmental needs, as no single technology holds the solution.

Policy Position (Mandates, Subsidies or Gov't Funding)

- ExxonMobil does not support subsidies or mandates
- Should governments enact legislation that provides research funding, we will consider such funding opportunities within the scope of our research efforts

Definition of "Commercially Viable" for algae biofuels program

- Algae-based biofuels are considered commercially viable when cost to produce the bio-oil is at parity with the long term forecast for a comparable crude.

IF ASKED About Chemicals Production (as referenced in the Alliance Agreement)

- Bio-oils produced by algae could be used in the production of certain chemicals. The ExxonMobil/SGI alliance includes, within its scope, the production of chemicals and lubricants using photosynthetic algae.

Alternatives Strategy

- Our strategy for alternatives and low-emissions energy technologies is two-fold.
- First, we've developed a variety of technologies available today, such as: tire liners that keep tires inflated longer, engine oil that increases fuel economy, and light-weight automobile plastics.
- Utilization of technologies such as these in one-third of U.S vehicles will translate to a savings of about 5 billion gallons of gasoline and greenhouse gas emissions savings equal to taking about 8 million cars off the road.
- Second, we are working on other new technologies both for the mid- and longer-term that address the need for both improved fuel economy and reduced emissions. For example:
 1. In 2009, ExxonMobil announced a \$600 million research and development project with Synthetic Genomics Inc. to develop biofuels from algae.
 2. The Global Climate and Energy Project (G-CEP) is a research collaboration founded at Stanford University in 2002 to research commercially viable energy technologies that have the capability of substantially reducing greenhouse gas emissions. ExxonMobil is a founding member with a contribution of \$100 million.
 3. We are investing more than \$100 million in a new technology for separating CO₂ from natural gas, which could help commercialize carbon capture and storage.
 4. We developed an improved lithium battery separator film for use in the next generation of hybrid electric cars.
 5. We are involved in advanced engine research that could significantly improve fuel economy.
 6. We are researching a way to generate hydrogen on board vehicles to power fuel cells which could improve fuel economy by 80 percent and reduce emissions by 45%.
- Since 2004, we have invested more than \$1.5 billion in operations to reduce greenhouse gas emissions and improve energy efficiency, and we will spend more than \$1 billion on additional initiatives over the next few years.
- In addition, we are spending more than \$4 billion on projects to reduce natural gas flaring.

Updated 5/24/10

J Craig Venter Institute Announcement – 5/21/10

The announcement by J Craig Venter Institute is not part of the ExxonMobil-Strategic Genomics algae biofuels program.

However, the capability JCVI has demonstrated could have applicability to the algae biofuels program.

Additional questions should be directed to JCVI.

