World Petroleum Congress, 2017, Istanbul

CEO Panel "The Importance of Research for Innovation"

July 11th

Tom Schuessler, President, ExxonMobil Upstream Research Company

Introduction Text:

Innovation is a topic about which I am very passionate. While innovation has been defined in numerous ways, at its core is the translation of an [HYPERLINK "http://www.businessdictionary.com/definition/idea.html"] into a good or service that creates [HYPERLINK "http://www.businessdictionary.com/definition/value.html"]. Our industry relies deeply on technology advancements, and ExxonMobil has always relied on continuous innovation enabled by sound research to not only maintain an advantage in a highly competitive industry, but also to meet our fundamental responsibilities as a global leader.

Commented [BR1]: Very good too.

As President of ExxonMobil Upstream Research Company, I see how our people are innovating every day. People know ExxonMobil as a leading oil and natural gas company, but at a more fundamental level, we have always been a science and technology company driven by innovation. That is the heart of what we do.

Commented [BR2]: Great opening paragraph

~~Our industry relies deeply on technology advancements, and ExxonMobil has always relied on continuous innovation enabled by sound research to not only maintain an advantage in a highly competitive industry, but as our fundamental social responsibility as a global leader.~~

Commented [BR3]: Very good too.

Our growth and success for over more than a century can be attributed to innovatively meeting the challenges of the time. With a constancy of purpose toward technology research and development and a long-term outlook, ExxonMobil has been able to do more with less, grow profitably, build capital efficiency, and maintain industry-leading performance. Today, we know that addressing the challenges and risks posed by globalization and climate change – while continuing to meet the world's growing energy demand – will require new and integrated technology solutions. We know that technology has the highest potential for advancing our energy and environmental objectives and for shaping our ability to respond to future demand. But responding to such challenges are not new to our industry. This industry has a long history of relentlessly pursuing and applying technologies that are designed to push the boundaries of possibility, but innovation comes with great uncertainty.

Commented [BR4]: Good sentiments, but a bit long

At ExxonMobil, our long-standing commitment to innovationthe development and application of high-impact technologies has has shaped our story and added unique value through eras of recoverable resource scarcity as well as eras of abundance. By approaching innovation and technology development across our integrated value chain, we are able to capitalize on our Upstream initiatives to identify and safely and efficiently produce oil and natural gas while also ensuring our Downstream and Chemicals products meet global customer demand. While our industry's technical capabilities and access to resource have changed over the years, our innovation has remained constant. Let me illustrate what I mean.

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Part 1: History and Resource Scarcity

In the early days of our industry, ExxonMobil innovations were required to drive the growth of our businesswere born of a growing necessity, enabling a mobile society and were developed to power an increasingly mobile society that was quickly beginning to see the benefits of oil and refined petroleum products. When WWII broke out, the petroleum refining process was nearing the summit of an evolution that had been in progress for some time. tThe industry was starting to be run by scientists and engineers who were developing chemically and mechanically complex processes and technologies that yielded more petrochemical products than ever before.

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Several ExxonMobil pioneering products provided key support to the war effort and heralded an era of increasing growth. These products included high-octane aviation fuel enabled by ExxonMobil'sby the development of the alkylation process; toluene, a war-critical product developed by researchers at ExxonMobil's Baytown Refinery, and butyl rubber, developed in 1937 by William Sparks and Robert Thomas in our research laboratories in New Jersey, providing a superior synthetic alternative to the limited supply of natural rubber to meet the expanding demand for tires and inner tubes on the battle front and in the growing automobile industry on the home front. Butyl rubber, by the way, is a good example of our integrated approach to research and development, as it relies upon a chemical reaction involving Vistanex, an adhesive also invented by company scientists.

Commented [BR7]: Too many examples

As demand for a broadening range of petroleum products grew throughout the following decades, focus on locating and accessing oil and natural gas increased. Technologies invented at ExxonMobil became key industry enablers for findinglocating and delivering to market and

delineating large accumulations quantities of hydrocarbonsf oil and natural gas once thought to be non-existent or technologically stranded.

ExxonMobil became a pioneer in reservoir simulation in the 1950's, continuing to expand and integrate reservoir modeling and simulation capabilities through to today. The invention of 3D seismic imaging in the 1960's allowed for more holistic visualization of the subsurface. It led to Dr. Peter Vail's discovery of seismic stratigraphy, now a widely adopted industrial practice whereby seismic images are used to assess the age of rocks, not just their composition, to more accurately determine where oil and natural gas deposits could reside. And once found, advances in reservoir simulation – which we continue today – allowed us to most efficiently drain the resources.

As access to resources tightened – and profitable resources became more scarce - ExxonMobil and the industry continued to innovate in order to bring these more challenging resources to market. Through the 1970's, ExxonMobil introduced specialized offshore and drilling technologies to help access commercial accumulations and bring product Nothing could be more representative than our progression in drilling to market. Examples range from diverless subsea template innovation we were the first to to drillingdrill the first horizontal wells in the 1970's and now , to leveraging our modern physics-based drilling approach we have to drilled 26 of the 30 longest extended reach wells in the world. [Something on artic or deepwater technologies??] From there, we have leveraged our advances in LNG, shipping optimization, and even high-strength steel used in pipelines to efficiently deliver product to high-demand markets around the world. This integrated, technology-driven approach represents a commitment to innovation that has pushed the envelope and relentlessly fueled business

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growth. In some cases, our unique and additive approach to research has led to enhancement of earlier inventions that continue to bring wide utility to our products _. Previously, I mentioned butyl rubber. 80 years after its invention, ExxonMobil remains the global leader in producing butyl rubber and the more advanced halobutyl rubber, which, when used in automobile tire innerliners, helps to save about 1 billion gallons of fuel and reduce emissions by 8 million tonnes of CO2 per year. That's equivalent to fuel used by about 2.5 million cars worldwide. Our steadfast approach to research and pursuit of innovative technologies have provided the edge to enter new markets faster, create customer loyalty, and maintain competitive advantage.

Commented [BR11]: Too many examples. Need to reference scarcity.

Commented [BR12]: This part doesn't tie with resource scarcity. But it is a nice example of "how we innovate" – through progressive and continual investment

Part 2: Era of Abundance

The last several years has seen the industry transform from an era of scarcity to one where there is an apparent abundance of hydrocarbons. How long this will last we are unsure, but what of the role of technology in this environment?

We at ExxonMobil believe that innovation will continue to provide differentiation in the market place, and we continue to invest approximately one billion dollars per year, aimed and driving down our cost of supply across the entire value chain and providing products that can hold a premium in the market place. Full Wavefield Inversion is delivering the next step in imaging whilst our Fast Drill technology suite uses high-end modeling of drilling physics that has improved ExxonMobil drilling rates by more than 80 percent compared to a decade ago, grossing over two billion dollars in cost savings since its inception. More efficient gas processing

technologies, such as cMIST™ result in natural gas treating and processing facilities that are significantly smaller, lighter, simpler, and cheaper to operate. And the application of data analytics - aided by our investment in high performance computing and PhD mathematicians and computer scientists - is helping to identify opportunities and efficiencies across our integrated value chain, from our global energy outlook to EMbark™ ship scheduling optimization.

Over the last few decades, industry leaders have sought competitive advantage through technology advancement and deployment to more efficiently capitalize on large discovered volumes and a maturing global energy infrastructure. The diversity of ExxonMobil's resource portfolio is supported in large part by the strength of our integrated technology research and development, into which ExxonMobil invests about one billion dollars annually. New demand for oil, gas, and petrochemical products stemming from globalization and the growth of emerging economies — that will account for 20% of the projected growth in energy demand through 2040 — has forced the industry to look beyond the conventional opportunity space for more remote and diverse supplies. For example, the rise of hydro-fracking has transformed the industry and given rise to the unconventional opportunity space. Emerging technologies with applications spanning ExxonMobil's global portfolio are driving down the cost of supply and increasing profitability and capital efficiency in the current market.

We continue to pursue and enhance our next-generation subsurface imaging technology, Full Wavefield Inversion (FWI), to significantly improve subsurface imaging, prediction, and resource characterization. Our pioneering reservoir modeling and simulation capabilities have come a long way over 75 years, recently leveraging record-setting high-performance computing

~~to model reservoirs for improved exploration and production. Our Fast Drill technology suite combines high-end modeling of drilling physics with structured well planning and design in an approach that has improved ExxonMobil drilling rates by more than 80 percent compared to a decade ago and has grossed over two billion dollars in cost savings since its inception. Recently, this technology has spawned an automated Drilling Advisory System tool that provides real-time operational guidance to the driller, resulting in a step change in drilling performance, cost savings, and reduced environmental impact. More efficient gas processing technologies, such as cMIST™ result in natural gas treating and processing facilities that are significantly smaller, lighter, simpler, and cheaper to operate. Data sciences and data analytics are helping to incorporate workflow efficiencies that are fast becoming differentiating capabilities with applicability across our integrated value chain, from our global energy outlook to EMbark™ ship scheduling optimization. These pursuits allow us to meet the increased demand we experience now and position us for the demand we predict in the future. They can also translate into less fuel needed for our operations and a proportionate decrease in air emissions.~~

Commented [BR13]: I struggle with this the most. Does not talk to abundance.

Part 3: Looking to the future – delivering more, and with environmental responsibility~~Energy Outlook~~

As we look forward, we see two fundamental objectives that need to be met in order for our industry to help society develop – delivering more energy, and delivering in a way that minimizes impact to our environment and our communities. ~~Technology has the highest potential to deliver breakthroughs in efficiency to do more with less, transform the industry~~

status quo, and tap available resources. That is why ExxonMobil's business strategy faithfully relies in part on our technological capabilities, and why a long-term view of supply and demand informs our investment plans. We forecast energy demand to increase 25% by 2040 with hydrocarbons being an integral part of the mix. Technology will be required to deliver this energy – and indeed to deliver it more efficiently – but what about the second objective? Driven by a growing middle class, improved standards of living, and emerging markets. Without efficiency gains, global demand growth could be four times the projected amount. Innovation in energy efficiency can be thought of as a large source of energy for the future. Over time, the technology advances that support energy growth are also powerful tools for reducing environmental impact. With strong gains in energy efficiency and significant changes in the world's energy mix – driven by economics and climate policies – we expect that by 2040, 40% of global energy demand growth will be met by natural gas and the CO_2 intensity of the global economy to be cut in half. While technologies can and do improve and change over time, one thing stays the same: ExxonMobil's belief that such advances will be key to reaching new sources of energy in the years ahead while improving our operational and environmental performance.

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Part 4: Social License and Technological Responsibility

As an industry leader, we understand and accept our responsibility to supply the world's energy needs in a socially and environmentally responsible manner – at a most basic level, the consumers of our product, our employees and our shareholders require us to. The market

demands reduce it's energy with a reduced environmental footprint. Good corporate citizenship demands that we pursue innovations in environmental stewardship to justify our license to operate and to be recognized as a partner of choice. Thisat is why we proudly pursue innovations in this areabreakithroughs in more efficient resource development with reduced environmental impact. , fFrom using working with Stanford to understand the effects of induced seismicity, software developed in collaboration with the Stanford Center for Induced and Triggered Seismicity to evaluate the risks associated with subsurface waste injection to reduce the risk of earthquakes deep underground, to developing Flexicoking technology to thermally convert heavy oils to lighter products and flexigas to generate electric power, to partnering with FuelCell Energy to test a novel research concept that uses fuel cell technology to cost-effectively capture carbon dioxide, to using the bi-products of algae grown in saltwater as a next-generation bio-fuel to potentially transform how we power transportation, to broadening the applications of petroleum-based polymers for lighter, more fuel efficient cars.

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Closing Statement:

As you can see, iInnovation is the common thread through our long history of providing the energy needed to improve our global standard of living. We must continue to innovate to produce and deliver the highest value energy products at the lowest cost to compete and succeed in any market. Through sustained investment and commitment to fundamental scientific research, the development and deployment of significant value-add technologies will fuel the future.

Thank you…..

Commented [BR16]: Maybe more pizazz, tighten up

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