

Testimony of Lee Edwards, President and CEO, Virent, Inc.

Before the Senate Agriculture Committee

Hearing on Energy and Economic Growth for Rural America

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Thank you Chairwoman Stabenow, Ranking Member Roberts, and distinguished members of the Committee. It is an honor and privilege to be here today and to speak with you about energy security and economic growth for rural America, issues that are critical to our nation.

My name is Lee Edwards, and I have been Chief Executive Officer of Virent, Inc. since 2009. Prior to joining Virent, I spent 25 years at BP, including as CEO of BP Solar, President for BP Pipelines North America, and Vice President of BP's Global Brand where I led the strategy, design, and launch of the current BP branding. I am also the Chairman-Emeritus and member of the executive committee of the Advanced Biofuels Association (ABFA) representing 38 member companies and a wide range of technologies, feedstocks, and products within the advanced biofuels and bioproducts industry.

Virent: Replacing Crude Oil

Virent is in the business of replacing crude oil. Headquartered in Madison, Wisconsin, the company was founded in 2002 and was spun out of Chemical Engineering research at the University of Wisconsin. Since that time the company has grown to 117 employees, doubling in size since 2007. At Virent we believe that our biggest strength lies with our people, from chemists to accountants to plant operators to machinists.

Virent's technology has proven the ability to scale, as evidenced through our state of the art, on-site demonstration facility, which is capable of producing volumes up to 10,000 gallons/year of direct-replacement biogasoline. In addition, our 25 pilot-scale plants, produce renewable diesel, jet fuel, and chemicals from a wide range of plant derived sugars. Virent's strong science and engineering pedigree combined with an experienced leadership team has attracted leading global companies in agricultural products (Cargill, Inc.), the oil industry (Royal Dutch Shell), and the automotive sector (Honda Motor Co.) as investors and partners. Virent's biogasoline is currently used by Shell to fuel the Ferrari Formula 1 race team. Most recently, in December 2011, Virent announced a new strategic partnership with The Coca-Cola Company to accelerate the commercialization of renewable, recyclable materials for 100% plant based beverage packaging.

Virent is replacing crude oil by commercializing patented technology that transforms renewable biomass into products that **are the same as** the fuels and petroleum-based products that

currently come from refining a barrel of crude – including renewable gasoline, diesel, jet fuel, and chemicals that can be used for plastics, packaging, clothing and other fibers. Unlike first generation biofuels that are focused singly on blending into gasoline or diesel, Virent’s renewable fuels and products have the potential to replace more than 90 percent of the petroleum-based products that make up a barrel of crude (Figure 1). Further, because these products are chemically identical to those made from petroleum, they are “drop-in”, meaning they can be seamlessly integrated into existing refineries, transported in existing pipelines, dispensed from existing tanks and pumps, and used to fuel any gasoline, jet, or diesel-powered engine (including marine engines) used today. This eliminates concerns around infrastructure investment, engine warranties and blending limitations. And Virent is not the only company at this stage – there are many that have exciting opportunities at the threshold of commercialization.

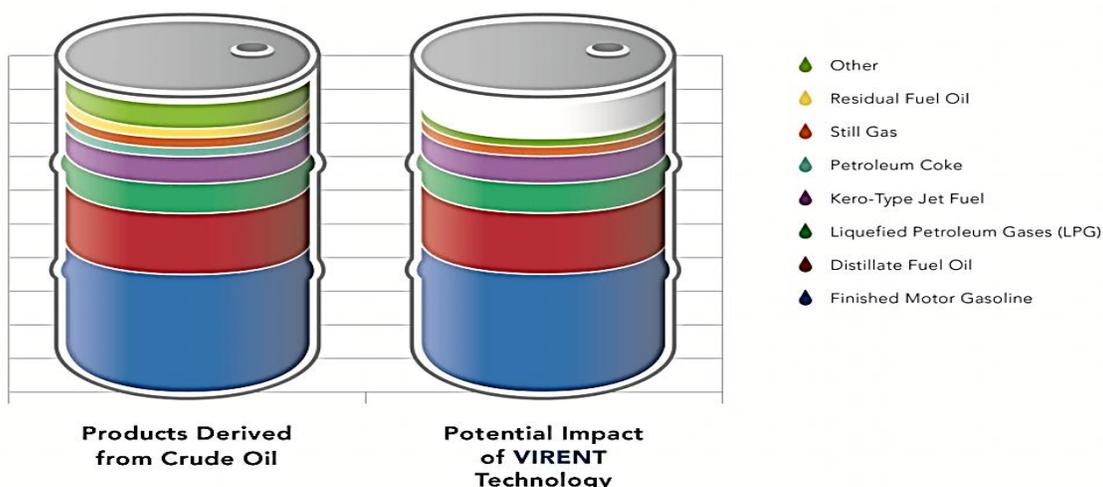


Figure 1. Replacing Crude Oil

Virent is a product of our longstanding national commitment to innovation. Programs historically supported by this committee have played a part in creating the environment for companies like Virent to thrive. To date, Virent has attracted \$75 million in private sector investment, from angel investors, venture capital and global strategic partners. Our success in securing private capital would not have been possible without several early stage research and development grants from the Federal government, including the USDA Biomass Research and Development Initiative (BRDI), the Department of Energy (DOE), and others. These Federal investments have provided critical research funding to test new concepts and develop the technology at the pilot and demonstration scale. There is no doubt that Virent’s conversion technology would not be where it is today – ready for commercialization – were it not for early R&D investments from the Federal government that facilitated early technical discoveries that

garner interest and investment from the private sector. To date, every government dollar Virent has received has been matched by nearly four private sector dollars.

Energy Security

The advancement of the biofuels and bioproducts industry will make a significant impact on America's energy security by replacing oil that is currently imported, often times from countries that are unstable, unfriendly, or both. By creating alternative pathways to liquid fuels and chemicals historically derived only from petroleum, we decrease our nation's reliance on foreign petroleum resources and diversify the marketplace, creating more competition. In particular, the efforts of USDA, DOE and the Department of the Navy to spur the development of biorefineries utilizing existing authority under the Defense Production Act funding have the potential to accelerate private investment and technology deployment. Additionally, the production of advanced aviation biofuels will also benefit our commercial and business aviation industries by reducing both price volatility and carbon emissions. I encourage the members of this committee to support these efforts.

Economic Growth and Job Creation: The Feedstock Value Chain

In addition to the energy security benefits of biofuels and bioproducts, biorefineries have the potential to transform the economic landscape of rural America. Currently, Virent is working toward deploying a first commercial scale plant to produce gasoline and chemicals from renewable biomass. The likely capacity of the first plant will be approximately 20 million gallons per year (or 42,000 tonnes per year of chemical products plus 6 million gallons per year of biogasoline). Deployment is estimated to create over 200 temporary construction jobs and 50 permanent jobs to operate the plant. However, even better than the job creation of the biorefinery itself, are the long term jobs and economic growth that will be realized along the agricultural feedstock value chain.

The deployment of first generation biofuels have already successfully opened up significant new opportunities for growth and wealth in rural communities. Deployment of the next generation of biorefineries producing a variety of renewable, drop-in molecules from a variety of feedstocks have the potential to exponentially increase markets for cellulosic material in every region of the country – from corn stover in Michigan, Iowa and Nebraska, to switchgrass in Georgia, to woody biomass in places as diverse as Arkansas and Vermont. And because new biorefineries will be most cost-effective if they are geographically close to their feedstocks, rural areas around the country will see the long-term economic benefits as these technologies are deployed at scale.

Virent is developing ways to break down a variety of cellulosic feedstocks into sugars that can be processed by a biorefinery. At our Wisconsin facility, Virent has utilized a variety of

feedstocks – including plant sugars from commodities such as corn starch, sugar cane, and sugar beets, as well as sugar from deconstructed corn stover, switchgrass, and woody biomass. The research done by Virent and its partners (which include private companies as well as two national labs, the National Renewable Energy Laboratory and Pacific Northwest National Laboratory) has proven the technical viability of deconstructing cellulosic biomass and converting it to biofuels. For example, in June 2011, Virent announced that it had successfully produced biogasoline from corn stover and pine harvest forest residuals as part of the National Advanced Biofuels Consortium funded under the American Recovery and Reinvestment Act (ARRA). Additionally, Virent jet fuel converted from cellulosic material was tested at the Air Force Research Lab at Wright Patterson AFB, Ohio and found to be a suitable alternative to petroleum derived fuel. However, feedstock producers and biofuels companies will need to continue working together to scale cellulosic deconstruction technologies on a timeline and at the volumes consistent with the deployment of biorefineries.

Challenges: Getting to Commercial Scale

The good news is that today the barriers to realizing this future are less about technology and more about commercial and policy risks – things we can control. In addition to accessing the feedstocks to convert to energy, we need to build biorefineries at a scale at which the volume of products are economical and be competitive with the existing refining sector. However, the capital required to deploy a commercial scale biorefinery is at least an order of magnitude higher than the cost of developing the technology or proving it at demonstration scale, and typically beyond the investment limits of venture capital (ranging from at least \$100 million to more than \$1 billion, depending on size and other factors). Private lenders are likewise unlikely to offer low-cost debt to finance a first-of-its kind, innovative technology, and even tax equity investors can be put off by the on-again, off-again nature of the tax incentives currently available in the biofuels sector.

Compounding these issues is a unique hurdle to attracting private investment for biorefineries - significant commodity risk on both sides of the value chain. On the input side, there is volatile pricing for commodity feedstocks such as corn starch or sugar and unknown or uncertain pricing (and uncertain availability) of cellulosic feedstocks. On the output side, biorefinery products must compete against crude oil prices that are even more volatile and that, further downstream, vary considerably by product (e.g. gasoline, diesel, jet fuel, or various chemicals).

Role of the Federal Government in the Farm Bill

Fortunately, several of the programs within the Farm Bill Energy Title are uniquely positioned to address these challenges. The Sec. 9003 Biorefinery Assistance Program, first established in the 2008 Farm Bill, has been successful in bringing private lenders to the table by guaranteeing a

portion of a loan for eligible biorefinery facilities. However, the Biorefinery Assistance Program currently requires eligible biorefineries to produce at least 51 percent *fuels*. Given that private sector interest in renewable chemicals to make products such as packaging and clothing is one of the biggest drivers for commercializing biorefineries, USDA should be allowed to give companies the flexibility to produce any mix of fuels and other products that the market demands.

Further, an inherent danger in defining eligibility for a program is that often technology and markets evolve faster and in different ways than government can anticipate. The Sec. 9001 definition of “advanced biofuel” – which sets eligibility for the Sec. 9003 program, among others – does not necessarily contemplate the full array of technologies, feedstocks, and products that companies are seeking to develop today. I urge the Committee to continue the Biorefinery Assistance Program, but also ensure that it does not preclude support for new innovative solutions with the potential to be more cost-competitive and with the ability to be most successful in the marketplace.

On the feedstock side, farmers and feedstock producers face significant hurdles in deploying the technologies and infrastructure necessary to bring commercial volumes of cellulosic feedstocks to market. The Sec. 9011 Biomass Crop Assistance Program (BCAP) has the potential to serve as an important tool for helping farmers and feedstock developers produce and deliver cellulosic feedstocks – which is a critical function if we are to realize the potential of affordable biofuels and bioproducts from non-food feedstocks.

Finally, the Sec. 9008 Biomass Research and Development Initiative (BRDI) program remains critical to seeding new agricultural and energy innovations and leveraging private dollars into early-stage development of more efficient and effective technologies. Since the 2008 Farm Bill, the program has focused on three areas critical to the success of the biofuels and bioproducts industries: feedstock development, biofuels and biobased products development, and biofuels development analysis. USDA biomass R&D can continue to play a significant role in advancing a variety of renewable, drop-in fuels and products and should be continued in the next Farm Bill.

Conclusion

Our country has unmatched agricultural and technological competitive advantages which should be true global differentiators. Historically, we have used these capabilities to fill our basic needs at a society, which certainly includes food, but also products such as clothing and energy. It is my view that we should continue to treat our country’s biomass resources as the strategic commodity they are. Technologies like Virent’s mean that plant sugars, the most plentiful substance on earth, have the potential to equal petroleum as a source of energy. Replacing crude oil with economical, domestic, renewable feedstocks offers our nation the

opportunity to build energy and economic security, long lasting jobs and a healthier world. American farmers and foresters, as stewards of our national biomass resources, will be essential to realizing this potential, and the Farm Bill has a significant role to play this effort to increase energy security and revitalize our rural communities.

I appreciate the opportunity to testify today and look forward to working with the Members of the Committee on energy programs in the Farm Bill.