Clean Energy through Biotechnology: Innovation, Regulation and Opportunities

CABS organized a "Clean Energy through Biotechnology" workshop on January 16, 2010 in South San Francisco Convention Center. Moderated by the chairwoman of CABS science committee, Connie Sun, five invited speaker covered a wild range of topics, including government regulatory landscape, emerging biotech-related opportunities, biofuel development in China, real life story from a biofuel entrepreneur and novel carbon reduction technology.

Ms. Tiffany Clay, an Associate with TPG Capital, presented the first talk on the landscape of energy and climate change policy. She first gave a brief introduction of the current state of climate policies, covering clean energy provisions in the stimulus bill, tax incentive for renewable fuel, renewable electricity and fuel standards, Cap and-Trade and EPA regulations. These policies reflect a dramatic shift brought in by the new Obama Administration. However, due to competing priorities and lack of momentum in the Senate, comprehensive climate legislation during this Congress looks unlikely. A possible outcome is that no legislation can be passed and EPA starts implementing rules of regulation of major emitters by 2011. Ms. Clay then went on to discuss the climate change policy from a global perspective. Before different countries can reach consensus, there are three major issues to be solved. First, defining emission-reduction targets, whether by total annual emissions or by annual emission per capita. Second, setting emission reduction targets. EU and Japan pledged more than 20% decrease on 1990 levels by 2020, while US would only commit 4%, pending the passing of current Congressional legislation. Third, sharing the cost. The developing world would need the help from developed world to finance their emission reduction efforts. Recent climate conference in Copenhagen laid the groundwork for a new global accord, which is planned to be finalized in Mexico City in November 2010 or South Africa in November 2011. Finally, Ms. Clay mentioned a few things for biotech to watch in 2010: new legislation from Congress on environment and climate change, such as Cap and Trade; tax incentives for renewable fuels; any global accord if passed. Biotech industry could use the new opportunities from furthering government support on renewable fuels.

Following Ms. Clay, Dr. Geoff Duyk, Managing Director form TPG Biotech, provided valuable insight on the challenges and opportunities in clean tech field. First, he summarized the macroeconomic drivers for clean tech, including requirement for energy security, sustainability and consequence of climate change. However, due to the financial crisis and weak economy, there were only 38 private deals worth of 2.1 billion dollars in 2009 on clean tech, much lower than the historical high of 16.5 billion dollars in 2008. The breakdown of 2009 private investment is 40% solar, 14% wind, 12% biomass and 9% battery. When talking about the new opportunities in clean tech in the future, Dr. Duyk said they can come from both supply side and demand side. Supply side, renewable electricity and renewable fuel generation, which are capital intensive, large-scale and requiring commodity exposure. Demand side, fuel conservation, energy storage and energy deficient, relying more on the technology solutions and being less capital-intensive. Specifically to the biotech-related field, Dr. Duyk mentioned potential opportunities such as more efficient biofuel conversion technology that will drive higher yields and lower cost; high margin bio-petrochemicals, petrochemical represent around 50% of the value per barrel of oil despite being only 3% of the volume. Feed stock represents another piece opportunity as well, once conversion technology gets mature, owning the feedstock will become attractive due to supply constraints. Dr. Duyk also discussed the potential of the emerging markets, such as Brazil and Asia, where lower cost feedstock, significant domestic demand and favorable government policy will drive attractive returns for biofuels.

Dr. James Zhang, Entrepreneur in Residence at Khosla Ventures, focused his talk on biofuel

development in China. currently China is facing tremendous energy and environmental challenges from fast-growing automotive market, shortage of domestic crude oil and became the largest contributor to green house gas emissions. To meet these challenges, Chinese government established ambitious mandates to increase percentage of renewable energy from 7.5% in 2005 to 10% in 2010 and 15% in 2020. Specifically, in 2010, bio-ethanol production should reach 680 million gallons and biomass power capacity of 4 gigawatt, By 2020, a projected 3.4 billion gallons bio-ethanol and 30 gigawatt biomass power capacity. On the other hand, the guidelines for biofuel development in China clearly indicate no competition with human for food and no competition with food crops for land. Given the shortage of grain and vegetable oil, grain ethanol and biodiesel are not the solutions to make biofuels in China. Feedstock for biofuel production in China can only be from biomass, such as crop residues or bio-energy crops grown on marginal land (land with high salinity or pH, clay or sandy soil not suitable for food crops, land not being used in winter season). Dr. Zhang believes research and development priorities for biofuels in China should be focused on developing energy crops and associated agronomic practices, creating more active catalysts for conversion of biomass to sugars and developing improved industrial microorganism. He predicts that China will be a close-follower of advanced bio-refining technology development since bio-refining technology can easily be transferred and there are both financing and market opportunities in China. major challenge will be related to feedstock availability, which can not be transported easily and feedstock varieties need to be developed locally.

Dr. Jack Newman, Sr. VP of Research from Amyris Biotechnologies gave a talk titled "Heart of an Entrepreneur". Dr. Newman is the cofounded of Amyris which was spun out of UC Berkeley in 2003. Amyris was launched with grant from Bill and Melinda Gates Foundation to use Synthetic Biology platform to produce anti-malarial drug, Artemisinin. In 2008 Amyris partnered with Sanofi-Aventis to scale up, commercialize and distribute Artemisinin combinational therapies. Besides the Artemisinin project, Amyris has also tapped into new opportunities in renewable fuel and chemical field. Utilizing the Synthetic Biology platform, branded "No Compromise", Amyris developed technology to produce jet fuel from sugar cane as feedstock. Dr. Newman showed the jet fuel produced by such technology performs well at low temperature and meets initial certification criteria. Right now, Amyris is working towards commercialization in 2011 and they have raised over $120 million in equity funding, including investments from Khosla Ventures, Klein Perkins Caufield and Byers, TPG Biotech and DAG ventures.

The last talk was given by Dr. Privhini Bradoo, Vice President of business development at Lanzatech. Instead of using crops or biomass as the feeding stock, Lanzatech developed technology that can convert gas into fuel and chemicals. Their core technology is based on a proprietary industrial microbe that produces ethanol and high value chemicals from carbon monoxide and hydrogen with excellent conversion efficiencies. Industrial off-gas from steel mill, syngas form municipal solid waste and steam reformed methane can all be cheap sources of carbon monoxide. Lanztech has optimized their proprietary control systems to allow highest rates of product synthesis and built a pilot plant at BlueScope steel mill in New Zealand. The plant is able to use steel waste gas to achieve commercial production rates and has been in operation for 12 months. Lanzatech is on the path to commercialization in two phases in the next two years. Dr. Bradoo believes that China may provide the perfect playground for Lanzatech technology since China is one of the largest steel producers in the world. ethanol market in China is already in place and there is strong interest in carbon reduction and low cost solutions.

More than 70 CABS members and guests attended this workshop. One attendant, Carol Cherkis, wrote to CABS in her email: "I am writing to you to say that the speaker's at today's Cleantech/Biofuels session were top-notch and that the session was much better than many other cleantech events for which I have paid a lot more money."