Stanford Energy Journal
Issue 4: Sustainable Transportation April 2014

Sustainable Biofuels: The Leading Edge of Sustainable Transport

Gerard Ostheimer

Transportation accounts for approximately 20% of total global energy demand; therefore, de-carbonizing the transportation sector is fundamental to reducing global demand for fossil fuels. Fortunately, the international community is starting to act on the need for sustainable energy. UN Secretary General Ban-Ki Moon and World Bank President Jim Yong Kim have committed themselves and their institutions to the success of the Sustainable Energy For All initiative (SE4ALL), which seeks to 1) achieve universal energy access; 2) double the use of renewables; and 3) double the growth rate of energy efficiency by 2030. Admittedly, these goals are highly aspirational and arguably arbitrary. Nonetheless, SE4ALL is elevating the conversation to the highest levels of national governments and focusing the minds of world leaders on renewable energy. Striving for these targets will guide the global economy simultaneously towards sustainable development, climate change mitigation, and a future powered by low- and renewable-carbon technologies. Let us consider how to double the use of renewables in the transportation sector and the roles that renewable carbon can play moving forward.

Secretary-General Ban Ki-moon (right) and Jim Yong Kim, President of the World Bank. (Photo: UN Photo/Eskinder Debebe)

The transportation sector represents a mix of technologies. Aviation, maritime, rail, heavy-duty vehicles, and light-duty vehicles for both public and private transportation all have inter-connected but diverse fueling requirements. In the fossil-fueled era, a single source is refined into diverse products that are specific to different transportation modes. In the renewable carbon era, fuels will be sourced by the inverse approach. Instead of diverse fuels from a single feedstock, diverse feedstocks will be channeled, in parallel, to their relevant demand. Sourcing different biomass feedstocks from diverse resources offers the potential for rural economic development across the globe, which stands in stark contrast to fossil fuel production.

Modes of personal transport are ever lighter and more efficient, and the market is beginning to offer both liquid and electric fuel options. Sustainable car fueling should account for local circumstances. In the bright sun of the American Southwest, electric vehicles are a natural fit, but in the mists of the Pacific Northwest, a sustainably sourced biofuel could be the way to go. Where biofuels will certainly be in demand for decades to come is the commercial transport of goods and people. Aviation, maritime, and heavy trucking require energy dense fuels, and hydrocarbons, despite our best wishes to the contrary, remain an efficient and convenient means of packaging chemical potential. Moving into the post-fossil fuel era, the key is to source hydrocarbons renewably. A diverse array of sustainably sourced biofuels will continue to fuel transportation in environmentally appropriate and technologically targeted ways.

Cognizant of the need for low-carbon energy solutions; the push to deploy sustainable biofuels is coming from both the public and private sectors. Multilateral organizations such as the International Energy Agency (IEA) and International Renewable Energy Agency (IRENA) see bioenergy and biofuels playing a considerable role in a decarbonized future. In order to reduce CO2 emissions by 50% by 2050, the IEA forecasts biofuels rising to 27% of world transportation fuels versus today's 2% . Serving as the SE4ALL renewable energy technology and policy "hub," IRENA developed the Renewable Energy Map 2030 that charts the way to doubling the amount of renewable energy. Biomass is expected to contribute 60% of the increased use of renewables, with biofuels contributing 15% of transportation fuel use . The private sector is leading the way. Boeing, Maersk, and Shell are among those driving technology development and deployment for transportation. KLM, SkyNRG, the Government of the Netherlands, and others recently announced the BioPort program to locally source aviation biofuels for Amsterdam's Schipol international airport. It seems that the goal of doubling the use of renewables is not so far-fetched after all.

Given the competing demands on agricultural land, how will we source enough biomass such that renewable hydrocarbons can make a meaningful contribution to the energy mix? Due to some poorly conceived and wretchedly

implemented biofuel projects in Africa and the unfortunate commodity price spike that occurred as U.S. biofuels production began to ramp up in 2007-2008, the conventional wisdom is that biofuels must compete with food production. Fortunately, biomass potential surveys from the U.S. DOE Billion Ton Study to various international evaluations (e.g. Dornburg et al., 2008) indicate supply sufficient to meet the IEA and IRENA scenarios. In addition, the Global Bioenergy Partnership, UN Food and Agriculture Organization, Inter-American Development Bank, and Roundtable on Sustainable Biomaterials have created tools for governments and businesses to guide the development of the bioenergy sector such that it is environmentally, socially, and economically sustainable. Biofuels should not be sourced from arid, food insecure regions, but where the land, water, and technical resources are available, bioenergy can be a powerful driver of investments in agriculture that drive increased agricultural production, improved resource management, and rural development.

As an example of the global potential for renewable hydrocarbons to help power sustainable development, consider the Addax Bioenergy Makeni sugar cane ethanol project. Addax Bioenergy has worked with the people of Sierra Leone to establish a bioenergy facility that dovetailed with local needs and potentials. They established a pivot irrigation system designed for local farmers to grow food crops between the circles of sugar cane. Building an ethanol biorefinery with a biomass-fired electricity cogeneration plant, the Makeni project is now poised to produce 85 million liters of ethanol and supply 15 megawatts of electricity to the national grid (a 20% boost in electricity production for the country). In addition, the project is certified sustainable by the Roundtable on Sustainable Biomaterials. Producing both liquid biofuels and biobased power while creating 2,000 new jobs, the Makeni project is a promising example of a way towards achieving Sustainable Energy for All. The prospect of biofuels powering sustainable transport has been a roller coaster. Fortunately, a number of international institutions choose to focus on moving the bioeconomy forward and creating opportunities for biofuels to contribute to a low-carbon future.

Dr. Gerard Ostheimer is the Global Lead for Sustainable Bioenergy under the UN and World Bank initiative Sustainable Energy For All (SE4All). He promotes the development of well-functioning public-private partnerships that work towards achieving SE4All's goals of increasing energy access and increasing the use of renewable energy. Previously, Dr. Ostheimer served as a Science Advisor for the Foreign Agriculture Service of the U.S. Department of Agriculture. He has a Ph.D. in molecular biology at the University of Oregon and did postdoctoral work in the systems biology of cancer at MIT.

■