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Policy Matters: Why Clean Fuels Forecasts Come Up Short

October 27, 2014 ***Jeremy Martin, senior scientist, Clean Vehicles***

Cellulosic biofuel facilities are opening this year to much fanfare and a renewed promise that we can look forward to a quickly increasing supply of clean, non-food biofuels. At the same time, forecasts about the future of cellulosic biofuel have recently gotten more pessimistic, with the Energy Information Administration forecasting a plateau once these first plants open. What to believe? I use a simple model to show how progressive, consistent clean fuels policies will lead to lower costs over time.

Learning by doing drives costs down

Experience with production brings many small improvements that reduce costs. Photo Credit: The Henry Ford Foundation.

As with any other new industry, scale-up issues have emerged for the cellulosic industry that were not apparent in the lab or at pilot scale. The pace of learning always accelerates dramatically once you spend hundreds of millions or even billions of dollars to start commercial scale production. This is exactly what I saw when we visited the Poet DSM and DuPont facilities in Iowa this summer. Everything from how to stack bales to the enzyme cocktail to the filter press that cleans the water at the end of the line are in a state of optimization. In theoretical treatments they call this process "learning by doing," and across a broad range of industries it has been observed that when you first start making something, whether it is a Model T or a solar cell, the cost per unit drops as cumulative experience with production rises (see this article in the Economist for some background).

Experience with production brings many small improvements that reduce costs. Photo Credit: The Henry Ford Foundation.

Predicting the future is hard

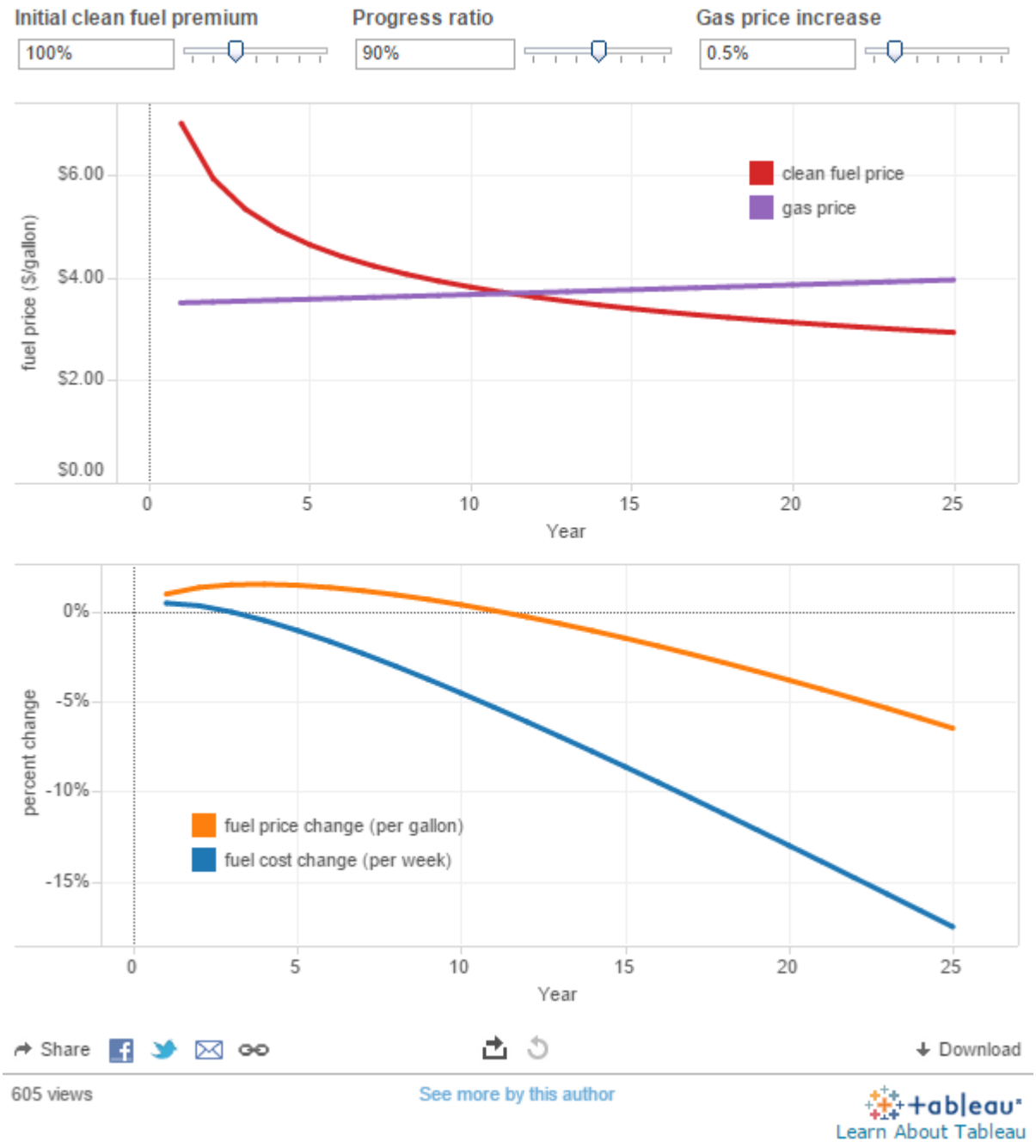
Fuel markets are complex, as are the models used to forecasts them – yet ultimately the predictive power of the models is rather poor. One of the most authoritative models about fuel that we all rely on is the Annual Energy Outlook published each year by the Energy Information Administration (EIA). It is really a collection of linked models that examine how policies, infrastructure, and economic factors in the vehicles, fuels, and the rest of the world interact. A complex model is needed to help think through complex questions, but the

complexity can make it hard to see the big picture. Some key dynamics are best illustrated with simple model with just a few parameters.

Building a simple model

To see what this means for clean fuels, let's construct a simple model of a Low Carbon Fuel Standard. Let's assume we have just two kinds of fuel, ordinary gasoline that costs $3.50 a gallon, and super-duper clean gasoline, which is carbon neutral and currently sells at a 100% premium or $7/gallon. At twice the price, demand for clean fuel is quite low until a low carbon fuel standard (LCFS) is adopted. The LCFS requires fuel producers to reduce emissions from their fuels by 1% each year, and in our simple model this means replacing 1% of the fuel with clean fuel in the first year, 2% the second, etc.

You might think that switching gradually from $3.50/gallon to $7.00 a gallon fuel would get expensive, but remember, the producers of clean fuel have a lot of room for improvement, and as the volume of production rises, experience starts to bring down prices. I put this into a simple model below so you can see the results for yourself. For illustration I started with a 100% initial price premium for clean fuel and used a simple model of learning where each doubling of cumulative production brings prices to 90% of their previous level, called the progress ratio (in other words prices fall by 10%). Finally we assume that gasoline prices rise by 0.5% annually. You can choose different values for these three parameters using the tabs at the top of the chart.



Results that speak for themselves

What you see is that while clean fuel prices start high, they fall rapidly. And since the policy ramps up the share of clean fuel gradually, the net result is that the per gallon price of blended fuel rises slightly for the first few years, peaks 1.5% above the baseline on the 4thyear, and then starts falling. And taking into consideration that cars are getting more efficient, so that average fuel consumption is falling by 0.5% a year, total fuel cost (the blue line) drops steadily almost from the beginning. Changing the parameters will change the numbers, but across a broad range of reasonable values the basic outline of the story remains the same.

Back in the real world, there are a lot of other details that matter. One important fact to keep in mind is that there are more than two types of fuels. Some of today's clean fuels, likeelectricity, are already less expensive than gasoline. And different vehicles and infrastructure constraints also complicate the story, which is why more complex models are necessary. But it remains true that the **cost of producing clean fuels will fall as volumes rise and firms get more experience.** This is an uncontroversial point, based on both theory and empirical observation.

Policy matters—it is the dog that wags the clean fuel tail

So why then, does EIA have such a pessimistic view of the future? Their model evaluates the current state of technology and policy and suggests that in EIA's view, current policy is not adequate to support the investment in production and distribution infrastructure needed to get clean fuels to a scale at which they can compete effectively. It does not anticipate various scenarios under which the policy environment has changed, so cannot paint a rosier picture than a current snapshot.

This creates a negative feedback loop: uncertainty about the future of clean fuel policies is delaying additional investment in the industry; the delayed investment is fueling (pun intended) uncertainty about whether the clean fuel policies are realistic. The oil industry is amplifying this negative feedback, arguing that policy makers should wait until the clean fuels are cheap and plentiful before moving forward with policies that support these fuels. But this cynical tactic is letting the tail wag the dog. Instead, policy makers in California, Oregon, and Washington should move boldly to support clean fuels production, and policy-makers in DC should resolve the uncertainty in the federal fuels policy landscape to reestablish the stable policy framework needed to support investment in clean fuels.

About the author: Jeremy Martin is a scientist with expertise in the technology, lifecycle accounting, and water use of biofuels. He is working on policies to help commercialize the next generation of clean biofuels (made from waste and biomass rather than food) that can cut U.S. oil dependence and curb global warming. He holds a Ph.D. in chemistry with a minor in chemical engineering.