In Chile earlier this month, Bio Architecture Lab broke ground on an experimental pilot facility producing ethanol from Macrocystis pyrifera (macro algae).

Macroalgae: that's seaweed, and more about why macro algae is really, really important, in a moment.

The Pilot Facility

The facility, expected to be operational in 2012 will allow the company to demonstrate a complete value chain from feedstock cultivation (seaweed farming) to advanced biofuel production; the company expects to scale-up by the end of 2015. BAL currently operates three seaweed farms in Quenac and Ancud in the Los Lagos region, and Caldera in the Atacama region of Chile.

Microalgae vs macroalgae or, er, seaweed

You can almost hear the pitch for technologies like BAL's:

Love algae? Well, darn, this is microalgae. Hate algae? Well, darn it, this isn't micro algae, its brown seaweed.

What's in a name. Sometimes, the very name of a feedstock can be important in getting the right attitude from investors. Think "vomit nut" is something you'd like to avoid – well, try jatropha. Rapeseed sounds a little strange to your ears, maybe canola will do better. False flax sounds like a feedstock filled with hyped-up claims – perhaps camelina is your ticket. Or how about lemna, in place of duckweed?

Macroalgae and the Range Fuels problem

Seaweed or macroalgae – either way, it might be better known as is an antidote to the Range Fuels problem.

You remember Range Fuels, right? The gasification project down in Georgia that chewed up more than $200 million in investment before petering out this year. The poster child for a US federal loan guarantee program in trouble.

We hear a lot about why Range Fuels failed, or why the USDA should have known better. But we don't focus quite so much on why the technology was of immense interest in the first place.

Well, to sum it up in one word, its about lignin.

That's pesky family of organic molecules that help trees stand up, and are as tough as nails to utilize for cellulosic biofuels conversion. There's that old saying – "you can make anything from lignin, except money."

That's, in part, what Range was all about. Where enzymes have trouble with lignin and generally have it as a by-product suitable for combustion to provide power for the processor, or perhaps some power fro the grid. But in gasification, you just blow everything up, with enough temperature to turn biomass into a hot steam of carbon monoxide and hydrogen, also known as syngas.

Pass it over a catalyst, or ferment it, and poof! You have cellulosic biofuels. And, back in 2007, Range Fuels had just about the only gasification technology around that seemed like it could scale before the end of the decade.

So, in went the money. And then, er, the rest of the story happened. Why? Essentially, because its much, much, much harder to make a biomass gasifier work at feasible costs than was generally hoped for or known at the time by the project's backers.

The shift to microalgae

Range's troubles don't change the potential of technologies that get around the lignin problem. So, when enzymatic hydrolysis didn't crack the problem, and gasification faltered…well, algae got white hot as a technology all over again.

That's right, algae doesn't have lignin. Shazam, the perfect workaround. Except that micro algae comes with its own problems. Foremost among them – how do you affordably get the water out of the algae or the algae out of the water? And what, then, do you do with all the residual biomass after the lipids are extracted?

Remember, in a 100 million gallon algal biodiesel project based on 25 percent lipids, you get about a million tons of residual biomass. That's enough to feed, say, about 180,000 cows. A lot of cows, that are currently eating, we suspect, something else.

So, you have enzymatic biofuels – and a lignin problem. Gasification – you get a motherlode of challenge in making the technology affordable. There's algae – you better know some hungry cows.

The seaweed option

Then, there's seaweed. No lignin, you can ferment out the sugars using some of the more well-understood microorganisms. The biomass is already aggregated. We know how to farm it (ever eat a California roll wrapped in…uh, farm-raised seaweed?). It doesn't compete with terrestrial food crops. You get a lot less residual biomass. You can grow up to 50 tons per acre in kelp forests.

All of which, potentially, makes ethanol produced from kelp forests a "bullseye fuel," solving the lignin problem by heading out to sea, where the forests use the buoyancy of seawater to hold up the biomass. And where there is no shortage of the "land" or seawater needed for scale.

So, that's the good news. And, if you are a Scandinavian, Korean or Japanese reader, you are probably dumbfounded that the Digest is using up valuable webspace to point this out. But aqua farming brown seaweed is less understood in some of the hotspots of advanced biofuels, such as the US, Brazil or much of the EU.

That's a shame, and should change. Although it doesn't change the fact that we only really know how to grow macro algae at food-production scale. With fuels, we need industrial scale.

Bottom line: BAL – science project or company?

Can BAL scale-up its seaweed farming to the thousands-of-acres scale? Well that's the big question. Is BAL an exciting science project, or a monster company in the making. They plan to launch at pilot-scale down in Puerto Montt, in southern Chile, early next year. In the shadow of the Andes, we'll start to get some new answers to the old problem.

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