The Oil Drum
DISCUSSIONS ABOUT ENERGY AND OUR FUTURE

Why new ideas take time to have impact

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As an opening warning, today I am going to write a piece of fiction. Not that it suggests that I am trying to emulate James Kunstler, nor is it going to have the drama of the Science fiction/Fantasy by authors such as David Weber, Lois McMaster Bujold, or Jim Butcher that, to pick but three I avidly devour. No what I want to do is to try and explain is why it takes new ideas about 20-years to go from idea to significant market impact. I thought it might be amusing to do this by following a *totally fictitious idea* *cough* from concept to impact level to show some of the barriers to progress. Dixie Lee Ray once tried to do this in explaining why, even if cold temperature fusion worked, it could not be an instant contributor to the national energy supply. Unfortunately I have lost that reference and so you are stuck with this, should you choose to read it.

Let's begin by saying that our protagonists are three faculty members: you, a young female electrical engineer called Angela, me, a somewhat old plant biologist called Burt, and Charlie, a medium career nuclear engineer. We are having a beer after classes end and I comment that in some work I was doing in Russia on birch trees I had noticed that one of the ponds on site had a thin oily scum on it. I'd brought samples back for testing and it seems as though the cause was algae, in the water, that was weeping a lipid. We all troop back to the lab for a look, and on top of the little reactor that I have built there is this thin film, but the water below is quite muddy and turbid, and this has been sitting there for quite a while. You suggest cleaning up the layers with a little applied electrical potential, and Charlie suggests a little radiation might weaken the algal cell wall and increase yield.

You have a little start-up funding left from your admin faculty appointment and hire a grad student to work on this, and within a few months the tank now contains an almost clear liquid in which, about half-way down, there is a thick band of the green, irradiated algae slightly disturbed by the flow of air and CO_2 coming from spargers at the bottom of the tank. At the top of the tank there is now a relatively thick band of oil, which is happily growing under the stimulation of the normal lighting in the lab. The grad student writes up a dissertation, and in a moment of caution you decide to patent what has been done, which makes the defense closed, and the report, for a short time unavailable to the public. The student was able to achieve a yield of lipids from the algae that calculates into 12,000 gallons/acre/year of biodiesel. So now, about eighteen months from the initial meeting in the bar we have some experimental data, but money has now all run out, and we need to start to get external support, since among other things you would like to get tenure.

(Working through a colleague you get some funding from a mining company to use the electrical

potential idea as a means of settling out fines in mining operations, that also works and leads on to you becoming a recognized expert in that field, which gets you tenure, and brings in money – but we will forgo that part of the story for now).

So where to get the money for the new idea (which you call IPEA – for Instant Production of Energy from Algae)? Well the nation is aware that there is a problem with gas prices and so we presume that it shouldn't be that hard to get some funding from one of the government agencies, and so we write off proposals to the usual suspects. Surprising to us, they are all rejected – to summarize those rejections we find that they range from just poor odds with some (acceptance rate about 1 in 15), through one agency where the reviewers comments dealt only with noting that none of the three of us had peer-reviewed publications in the area, to a suggestion that we find an international energy distributor (petroleum based suggested) to work with. (We try that, but though we talk to more than one corporate vice=president and they promise to call back . . . .they never do, not even the ones running the adverts on TV).

Now, while we had been writing these proposals the campus had been trying to show how up-to-date on research in areas of national need they are, and so they had been publicizing the work that we have been carrying out, and between us we have given a number of local presentations to small groups and state organizations. At this point Derek enters the picture. Derek works in the venture capital field, and after visiting the lab, and seeing the results negotiates an agreement with us and the University to form a company to exploit IPEA. By the time that all the agreements, and funding is in place it is four years since that initial meeting in the bar. (This isn't MIT, folks).

With funding now available it takes only another year of accelerating the lab-work and tweaking current levels (very low) and species modification and irradiation to the point that the yield in the lab has reached 15,000 gal/acre/yr and it is time for the first field test.

We negotiate a small site on University property where we dig a small pond, and line it with clay. One of the mechanical engineering grad students comes up with an ingenious device that harvests the oil layer and feeds it into a vertical column, where it is trans-esterified and converted into biodiesel and glycerin by the time that it gets to the bottom. It took a year to get the permits to carry out these tests, and it takes a year of running the pond to show that it will produce oil consistently in all seasons (hey, they survived Russian winters), and to acquire data on production yields with time. A simple ground source heat system laid with the pond keeps the temperature in the water warm enough for sustained growth, and the data confirms that the lab predicted yields are achievable. The small amount of biodiesel generated is used in university vehicles, bringing publicity to the campus, and expressed interest and support from the Governor of the State.

As we enter the eighth year since the creation of the idea, we are now ready to move to the first prototype of a full-scale farm. Over the year that the trials have been going on we have talked with one of the mining companies that support your other work, and they will make one of their abandoned quarry areas available, since this will give a pond that is already carved in shape, and just needs sealing. It is five acres in size. However, at this scale it is now necessary to get the necessary permits for air and water, and since this interferes with normal land reclamation plans, additional inputs must be made to the state to allow modification of the mine's earlier approved reclamation plans. To get these permits, and to install the equipment for the farm takes two years, even with the head start of the year of pre-planning that we did while the first pond was being tested. Again we run the system for a year in order to validate the seasonal and diurnal production rates. Half-way through the year a contractor, who has been bringing in the

pasteurized sewage that is used as the algal nutrient, draws the supply from the wrong tank, and feeds the pond raw sewage instead. Production doubles, but the tests are continued for another year to ensure that there are no additional health issues generated from the change. We find that the site works best when we break the pond into modules that are about a quarter of an acre each.

It is now at the end of year eleven, and over the course of the two years of field testing approval has been obtained to use a mine tailings site as the location for the first full production farm. The site is two square miles in size. The farm site is near a power station that will provide the CO2, and a small town that will provide the sewage and labor. (This fosters the new Governor's stated goal of re-building rural communities). However issues of air quality (there is a faint smell of oil given off by the lipid as it floats over the pond) and risks to wild life, and other areas of concern from national environmental groups extend the time needed for permitting by another year, and mean that it will take a full three years of testing and validation of this farm before the Government will approve the process for franchising and full scale development.

At this point, although successful at every point it was tested, IPEA is still only producing 30,000 (gal per acre) x 640 (acres per sq mile) x 2 x .75 (efficiency factor)/(42 x 365) = 1,880 barrels/day. With biodiesel by this point getting $25 per gallon on the market, it is however, not unprofitable, and Derek is able to franchise the concept to some 200 sites over the course of the next two years, with each requiring their own permits and engineering. At the same time the modular concept becomes popular with farmers, who set up small ponds on their own to produce enough for local needs. It takes a further three years to get the larger sites into full production, and thus it is a full twenty years after that meeting in the bar that you sit in your office and contemplate the impact that your idea is finally starting to have on international supply. (By this time I am in a rest home, and Charlie has long ago moved into the nuclear industry, from which he recently retired).

Derek comes to visit and brings a handsome present (though not from a top jeweler you note). He wants you to have it as a remembrance of the work you helped found. "But what about our basic patent?" you ask, thinking that this would now fund your retirement.

"Oh, that ran out three years ago," he commented, as he closed the door behind him.

Well that's the story, and obviously I shouldn't quit my day job. But hopefully you can see that there is no "quick fix" that will allow a new idea to solve market demand in the short term. Depending on the solution, and the permits needed for large construction (Nuclear times are much longer than those I have cited) this process could be extended considerably beyond the times given. One cannot circumvent the steps upward in scale that must each be judged and evaluated before the next step is taken. Thus each step takes pre-planning, permitting, and operational time before one can move on to the next.

There have been some ideas that I have seen that, being simple, have been adoptable by industry in a relatively short time, but they have been based on the use of a tool developed by one industry into another. Where a new concept is introduced, particularly where it needs a supporting infrastructure, a twenty-year time frame is much more likely to be the case for the time needed for significant impact.

(Note - it is the Editor, not the author, who currently has a cold - grin)