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PRESENTATION

Operator

Good morning, and welcome to the Green Plains Inc. and Green Plains Partners Fourth Quarter and Full Year Earnings Conference Call. Following the company's prepared remarks, instructions will be provided for Q&A. (Operator Instructions)

I will now turn the call over to your host, Phil Boggs, Executive Vice President, Investor Relations. Mr. Boggs, Please go ahead.

Phil Boggs - *Green Plains Inc. - Executive VP of IR & Treasurer*

Good morning, everyone. Welcome to Green Plains Inc. and Green Plains Partners Fourth Quarter and Full Year 2021 Earnings Call. Participants on today's call are Todd Becker, President and Chief Executive Officer; Patrich Simpkins, Chief Financial Officer; and Leslie van der Meulen, EVP, Product Marketing and Innovation. There is a slide presentation available and you can find it on the Investor page under the Events and Presentations link on both corporate websites.

During this call, we will be making forward-looking statements, which are predictions, projections or other statements about future events. These statements are based on current expectations and assumptions that are subject to risks and uncertainties. Actual results could materially differ because of factors discussed in today's press releases and the comments made during this conference call and in the Risk Factors section of our Form 10-K, Form 10-Q and other reports and filings with the Securities and Exchange Commission. We do not undertake any duty to update any forward-looking statement.

Now I'd like to turn the call over to Todd Becker.

Todd A. Becker - *Green Plains Inc. - President, CEO & Director*

Thanks, Phil, and Good morning, everyone, and thanks for joining our call today. Our transformation continues to gain momentum. We continue to execute on key milestones necessary to achieve our 2024 and 2025 transformation, and we are making great strides towards achieving these goals. 2022 is shaping up to be a transformative year, and we are excited to review our progress and ongoing initiatives.

We released our inaugural sustainability report late last year and are planning to release another in Q2. The market is starting to realize we are a true ESG story. We always have been, but we haven't always been forward about telling it. That has changed, and we have made significant commitment to reducing our GHG footprint 50% by the end of the decade and be carbon neutral by 2050. These aren't idle goals and we have a concrete path to achieve them and more.

For the fourth quarter, as we had indicated earlier, we had hedged our consolidated crush margins early. We strategically did this in order to reduce our risk and protect the capital that we had raised to execute on our transformation and ended the year with over $680 million in cash equivalents as well as additional liquidity from available credit facilities.

We achieved $0.20 per gallon in the consolidated crush and approximately $0.17 for the full year. Overall, in 2021, these results are in line with what was available in the daily average crush as we had significantly overachieved in the first half of the year. If we would have not hedged anything all year, our year would have not been substantially different, although the fourth quarter would have been higher, making up for extreme weakness in the first half that we avoided by hedging and risk management.

Q4 was unique for many perspectives and unprecedented, maybe the only time we will see this. With that said, we manage for the long-term financial stability of Green Plains.

Operationally, utilization at our Madison and Mount Vernon locations were impacted by supply chain constraints tied to national chip shortages and labor tightness, which delayed completion of these upgrades, limited our opportunistic gallons. Just this week, we started one side of the new Mount Vernon dryers and expect the full system to be operational late this quarter.

Additionally, our York location experienced grain bin damage during the quarter, which limited overall utilization at that location as well. While we are thankful that no one was hurt as a result of this accident, the combined challenges to the quarter in utilization from these 3 locations resulted in lost opportunity given the expansion of the crush in the spot market.

We continue to be focused on running Green Plains 1.0 well in order to execute on Green Plains 2.0. The fourth quarter also included some negative impact from mark-to-market items in our export business as well as some higher eliminations from ethanol gallons and renewable corn oil shipments that weren't delivered due to logistics challenges in the U.S. at the end of the quarter. Combined, these items reduced our results by about $8 million. Much of it will come back over the first couple of quarters in 2022 as deliveries on those positions got executed. On top of that, the York incident took over $5 million out for the quarter as well.

Margins started out soft in 2022 as stocks and production levels built and increased fast. With current logistical challenges in trucking and rail service on the carriers, we saw the industry slowdown and stocks grew this week. This along with the fact that ethanol is a significant discount to RBOB and the RIN values remain elevated, we believe the discretionary blender is fully incented to blend more ethanol. While hesitant to call a bottom to the margin structure with gas demand rebounding this week as we get out of winter with mild temperatures, driving demand can clear this excess quickly.

In addition, it looks like more parties continue to take advantage of a flawed Chicago pricing mechanism, which sent the market to new lows on very little volume as we continue to argue for a better way to price 1 million barrels of ethanol production per day for the industry that are impacted by a few million gallons of sales in the window.

Finally, as global economics begin to put the pandemic behind us, we believe we could see strong energy and transportation demand as we move through the year. More importantly though, the market needs fuel ethanol plants to run as vegetable oil demand have been robust and prices continue to move higher.

In addition, we are seeing strong demand for high protein ingredients, particularly after we started up our second MSC location and begin to demonstrate our increased size and redundancy to the market. I will discuss that later in the call, the positive impact to our strategy for what seems to be potential shortages in many of our products.

We are scheduled to begin our 60% protein trial at Wood River in the next week or 2 and we are excited about the potential to produce a new value-added ingredient that can be used to target the aquaculture space. We are working with our aquaculture customers who are excited to get samples of the new product, and we believe this can be transformative for us and our program.

We have a long-term goal of moving beyond protein levels in the 50s and fully operating in the 60s and above, and we'll know more shortly on that opportunity.

We broke ground on Obion in the fourth quarter and are on track for a mid-2022 start-up of the patented MSC protein system at Obion, Mount Vernon and Central City and the plan to break ground at Tharaldson this spring as soon as the ground is thawed. The long lead time equipment is in place, and we are executing our start-up plans.

Green Plains Partners was able to increase their distribution this quarter to $0.44 per unit. We are pleased to increase the distribution for a second quarter in a row. The partnership is committed in long-term minimum volume commitments resulting in a strong and stable cash flows. I will come back on the call to provide an update on our exciting ongoing initiatives for 2022 and beyond and spend time on all of our verticals, protein, oil, sugar and carbon.

Now I'll turn the call over to Patrich to review both Green Plains Inc. and Green Plains Partners financial performance.

George P. Simpkins - *Green Plains Inc. - CFO*

Thank you, Todd, and Good morning. Green Plains consolidated revenues for the fourth quarter of $802.3 million were higher than the same period a year ago of $47.8 million, driven mainly by higher prices and run rates. Our plant utilization rate improved year-over-year and for the fourth quarter with an 83% run rate during the period, which compares favorably to a 76% run rate in the prior year fourth quarter.

We anticipate concluding final startup items at Madison, Mount Vernon and York during the first quarter, putting us in a position for higher utilization rates as we move through 2022.

For the quarter, we reported a net loss of $9.6 million or $0.18 per diluted share compared with $49.6 million loss reported for the same period in 2020. Adjusted EBITDA for the quarter was $32 million, comparing favorably to $9.4 million in the prior year quarter, largely due to stronger ethanol crush margins realized in the quarter, offset by a year-over-year decline in contributions from Ag and energy margins, largely due to favorable natural gas optimization in the prior year.

Our net loss for the quarter included a nontax charge of --- noncash tax charge of $4.8 million related to a valuation adjustment on our deferred tax assets. For the period, we realized a $0.20 per gallon consolidated crush margin in the quarter and a $0.17 per gallon crush margin for the full year as a result of ethanol fundamentals, strong corn oil pricing and protein sales.

For the quarter, our SG&A cost for all segments was $18.2 million compared to $22.8 million in Q4 of 2020, driven by an adjustment to our accrued compensation during the quarter, partially offset by higher costs from the addition of Fluid Quip SG&A expenses.

Interest expense of $6.9 million was favorable to the $10.5 million reported in the prior year fourth quarter, driven mainly by a combination of a change in the treatment of interest expense related to our convertible debt in early 2021, extinguishment of debt associated with our 22 and 24 converts, offset by issuance of 27 converts and the effect of capitalized interest.

For 2022, based on expected debt levels, cash interest expense should average approximately $10 million per quarter before capitalized interest, which will result in lower reported interest expense.

Income tax expense for the quarter was $4.8 million, which represents a cumulative income tax adjustment for the year. As we've discussed before, Green Plains remains in a net cumulated loss position, and as a result, we cannot use our NOLs or credits until we demonstrate consistent income. We therefore, have to reserve against any future tax benefits in the interim.

On Slide 9 of the earnings deck is a summary of the company's balance sheet highlights. We ended the period with $698 million of cash and net working capital compared to $302.8 million for the prior year, reflecting the results of the successful capital campaign during 2021 in support of our growth objectives. Our liquidity position at the end of the quarter included $685.8 million in cash, cash equivalents and restricted cash along with marketable securities with approximately $287.8 million available primarily under our working capital revolvers and delayed draw term loan.

For the quarter, we allocated $62.3 million of capital to profit sustaining and growth projects, including $42.4 million to our MSC protein initiatives and approximately $15.3 million towards maintenance CapEx, safety and regulatory capital, with total CapEx ending the year around $187.2 million.

As we look at 2022, total CapEx is anticipated to be in the range of $250 million to $300 million, including approximately $27 million of maintenance capital with another $18.6 million of capital rolling over from 2021 projects that should be completed in the first quarter of 2022. The balance of our capital spend will be allocated to MSC protein and other key growth initiatives.

This remains an important year for the company as we plan to deploy significant levels of investment capital raised over the past 12 months toward achieving our transformation initiatives.

I am pleased to report the partnership realized an adjusted EBITDA of $12.2 million for the quarter and continues to perform according to plan. EBITDA was down from $13.8 million for the same period a year ago as a result of the sale of the parent's Ord and Hereford plants.

Refinancing of the partnership's debt earlier in the year, combined with continued performance supported by MVCs enabled the partnership to enhance returns to unitholders by increasing the quarterly distribution to $0.44 per unit while maintaining a 1.05 coverage ratio for the quarter. For the partnership, distributable cash flow was $11 million for the quarter compared to $11.3 million for the same quarter of 2020.

Over the last 12 months, adjusted EBITDA was $52.1 million, distributable cash flow was $45.4 million and declared distributions were $26.4 million, resulting in a 1.7x coverage ratio, excluding any adjustment for the required principal payments amortized in the past year.

Now I'd like to turn the call back over to Todd.

Todd A. Becker - *Green Plains Inc. - President, CEO & Director*

Thanks, Patrich. So our theme of execution on our strategy continues, and I'd like to walk you through an update on each of our strategic pillars. First, on our value-added ingredients and ultra-high protein initiatives, we continue in construction mode and we are planning on bringing 4 locations online during 2022 and early into 2023. Including our turnkey partnership, we plan to have over 700 million gallons converted, producing over 400,000 tons annualized in early 2022.

We are seeing strong customer interest as represented by multiyear MOU in the pet space we announced last quarter and have continued to see growing demand, adding additional customers in all areas. We are in substantive late-stage discussions with partners to use our ultra-high protein products as well as production of ingredients using our products in aquaculture as the demand for plant-based alternatives to soy and fish meal are growing globally. We expect announcements to be forthcoming during Q1 and Q2 of this year.

One key is the 60% protein trial we are starting this month, and if successful, we believe we will have good visibility into potential aquaculture demand. We have a high degree of confidence we will find our path to much higher protein concentrations.

The world is short protein thesis remains intact and is especially relevant to our products now and in the future. The addressable market for ultra-high protein at just 5% inclusion rate in feed rations, our addressable market for our novel ingredient is over 14 million tons. And when completed, our production will be approximately 700,000 tons, well below what's needed, but one of the largest new and novel plant-based proteins in many decades at real scale to make a structural shift in what we feed our pets, our farm raised fish and also swine dairy and poultry. We also believe a successful 60% or higher protein product will be ultimate differentiator.

The recent price move in all things protein is just more evidence that world demand for protein will continue its trajectory over the last 20 years and start to accelerate again where more and more supply will be needed, alleviating fears of expanded soy crush production pressuring markets globally. We believe trade flows will continue to change and prove to be continually beneficial to ultra-high protein production or any protein for that matter.

Regarding our renewable corn oil strategy, we continue to see strong demand and high values for vegetable oils overall and for our low carbon intensity score renewable corn oil. While pricing took a brief pause in the fourth quarter, we are now seeing robust demand and pricing return to the industry and expect acceleration of values towards the end of 2022 as the renewable diesel industry is expected to double again this year on its capacity.

Our yields have improved with the addition of MSC to Shenandoah and Wood River, and our teams are focused on maximizing our corn yields, which is the most valuable pound-for-pound component of the corn kernel. We continue to anticipate that our annualized production exit rate this year will be over 330 million pounds after factoring completion of the ongoing MSC projects this year, heading towards 400 million pounds per year once everything is completed.

In corn oil, as in protein, we are in substantive discussions on how to partner our feedstock to increase returns for our shareholders. I will share more thoughts on that at the end of the call, and believe being patient has only increased the value of this part of the business as we have a structural advantage by owning and controlling IP around expanding yields, not only through MSC systems, but also stand-alone technologies Fluid Quip is in the process of developing.

One of our most exciting updates is on the clean sugar front. As a reminder, Fluid Quip invented and owns the unique patented process that will produce clean sugar or dextrose from a dry milling operation. This is a completely disruptive technology that can increase the value of our assets exponentially in our opinion.

Why do we call it clean sugar? Because study after study has indicated we produce a dextrose that is at least 50% lower in carbon intensity, a lot cleaner than dextrose produced in a wet mill using a completely different, more energy-intensive process.

We have been busy at our innovation center at York getting ready to scale this up and produce commercial volumes of clean sugar. We have completed the FEL 1 study and are ready to begin detailed engineering on a large-scale commercial system. We currently don't see any other substantive technology risk in other unit operations in the clean sugar process.

We believe we are making good progress on colocation discussions and offtake agreements as we have sent more and more additional unique clean sugar samples to potential customers. Our engineering is being done with a plan to break ground in the second half of 2022 on a clean sugar system at one of our biorefineries. This will most likely involve dedicating a portion of the corn grind at a facility rather than a full scale conversion to start, which will allow the system to continue to scale up, while also leaving flexibility to produce ethanol depending on market conditions.

A commercial 30,000 bushel per day system, the equivalent of over 30 million gallons of ethanol, should produce close to 400 million pounds of clean sugar or dextrose annually. We also believe our cost of production using our patented low-carbon technology is competitive to other products out there today.

So who is interested in our product? We believe this type of product is the in-demand feedstock for the bioeconomy that is upon us. We are talking with customers from synthetic biology to green chemicals to bioplastics to enzymes to just about anything that is being made in a fermenter. And all the results have been positive.

Finally, on carbon, we remain focused on how to best monetize this last piece of the corn kernel other than clean sugar, which does it on its own. Our team is reviewing opportunities at our 3 Southeastern locations and the potential goes beyond just direct injection. 8 of our other locations remain committed to Summit Carbon Solutions project to capture the fermentation CO2 from these plants, lowering their CI scores dramatically.

We have continued to assess the use of our capital to help fund the Summit pipeline and remain in discussions to do this. Summit continues to make progress on standing up the pipeline. From compression equipment to site designs to permitting processes to survey permissions to starting to execute right away agreements to cost estimates and engineering and drilling the first stratigraphic test well to port space acquisitions, this project remains on track and we are excited to be a shipper and an early owner.

This project has a winning formula as it focuses on the health and longevity of U.S. agriculture and the farmers who depend on the U.S. ethanol industry to remain a viable place to sell their crops.

We remain optimistic that the clean energy portions of the Build Back Better Bill will ultimately make their way to some form of legislation that will pass. The expansion of the 45Q tax credit for carbon capture and sequestration and the new sustainable aviation fuel tax credits are both items that could also provide tailwinds for Green Plains.

We are closely monitoring the various competing technologies for alcohol-to-jet opportunities to produce sustainable aviation fuels and believe this could be an important development for the industry over the long term. This is still very early days for ATJ and we at Green Plains have undertaken a full technological review of available technologies and others that are nascent, looking for a partner to help commercialize them as well. More to come on this, but we believe there's plenty of time on this opportunity.

Finally, let's take an opportunity -- let's take a look at the opportunities for Green Plains to create significant value for our shareholders. We believe our investment and ownership in Fluid Quip and the IP portfolio with our partners is the leading agricultural technology opportunity in the world today. In 2021 alone, we were issued an additional 7 patents, 5 in the U.S., 1 in Canada, 1 in Brazil. We received several notices in late 2021 as well, which should go active in 2022. This all bolsters our IP, and we will defend against infringement. We believe there may be some of that going on.

We are not a company that just buys someone else's technology anymore. Our technology is starting to accrue real value, in my opinion. The opportunities to monetize the products from a kernel of corn using our IP continues to expand, and we aim to capitalize on those opportunities.

So what does this all mean for the value of Green Plains today and in the future? Other than the volatility in our Gen 1 fuel platform, we can start to look through that as we see our transformation take shape in 2022, getting ready for 2024 and beyond.

Our non-ethanol margin guidance from last quarter for 2022 remains the same. With corn oil pricing once again touching $0.70 per pound, we feel comfortable that corn oil itself could contribute over $140 million to $150 million of EBITDA during 2022 at $0.65 a pound on average. Ultra-high protein contribution is still estimated to contribute between $40 million and $60 million as well in 2022. And on top of that, the rest of the platform from specialty alcohol to Ag and energy will be additive, less, of course, corporate SG&A.

As we are still transforming and not transformed, fuel ethanol economics will also need some recovery from current levels, to not take away from anything, and be additive to these numbers. We are growing in confidence that we can produce clean sugar at scale with base margins significantly higher than traditional dry mill economics. This patented and own technology can truly be disruptive.

And lastly, we are in the beginning stages of decarbonization to produce sustainable ingredients that matter as our stakeholders expect us to do all of this in a responsible manner.

Thanks for joining our call today, and we can now start the Q&A session.

QUESTIONS AND ANSWERS

Operator

(Operator Instructions) Our first question comes from the line of Craig Irwin from ROTH Capital.

Craig Edward Irwin - *ROTH Capital Partners, LLC, Research Division - MD & Senior Research Analyst*

So I guess nobody in their right mind owns Green Plains for ethanol. So I'll let the analysts that didn't pay any attention to your hedging comments previously bug you about the details in the quarter. I would say congratulations on the operating progress. Todd, the key question that I'm getting from investors this morning is the 400,000 tons of Hi-pro that's going to be produced in '23. When do we start to get visibility on pricing there? I know you're working actively with a large number of different customers. It's exciting to hear. 60% is going into trials. How does it take shape? What should we be looking for? And what do you see as a reasonable scenario?

Todd A. Becker - *Green Plains Inc. - President, CEO & Director*

Yes. We are in process -- continued process of evaluating markets for our products. We already are in pet food that has traded at a premium to high-protein soybean meal prices today. Today, high protein soybean meal is about $200 to $250 premium over traditional DDGs. And remember, just at that price, every $100 a ton is about $0.06 a gallon equivalent. So baseline, just on protein alone, you're starting to see that type of premium if you're just comparing it to high-protein soybean meal. And every $100 above that is obviously another $0.06 a gallon, not including the uplift from corn oil that we don't even include in those original corn oil numbers.

So when you take a look at all of that -- our first goal is to get and stand up higher protein concentrations. And we didn't want to stop at 56% and 58% and get the market really primed on that. We really believe we can and will achieve higher protein concentrations with our partners from a biological perspective. And we really wanted to kind of wait, and before we extend contracts extensively in volumes, to see what our success is on the upcoming 60 pro commercial trials. And if we're successful there, then I think our first stop is to start competing against things like soy protein concentrates and other products that are priced at $800 to $900 a ton.

On top of that, when you think about just the breakdown of our product today, it's 75% yeast and 25% -- 75% protein and 25% yeast. If you take the price of the 75% protein and the price of the 25% yeast comparable in the market today, our products should be worth $800 a ton. And so our focus starts there, and we start to think up from those levels.

The key is being able to make that product and get it into the market. We are working with customers from South America to Europe to the Mediterranean to North Africa and to Asia and focused on these higher protein products and really not taking a lot of time spending with them on the 50 to 52 protein products because we believe that our differentiation -- we're on the verge of differentiation, and we'll know a lot more in the next kind of 30 to 60 days on the success of these trials.

So the look will come later in the year as we determine what we're going to start these new sites up with and what protein we're going to start them up with. And at that point, I think we'll be able to give the market a much better look, except to say that we built the systems based on a $0.12 to $0.20 a gallon margin, which is based on a $200 to $350 premium over distillers' grains. We are able to achieve that today and more in -- and as high as that in pet food and aquaculture. And we're in deep discussions, substantive discussions in several areas with all of our customers, with all of our species to put something in place that I believe will be really exciting for our shareholders.

Craig Edward Irwin - *ROTH Capital Partners, LLC, Research Division - MD & Senior Research Analyst*

So as a second question, I wanted to ask about the Novozymes relationship. You did maybe touch gently on the subject in your response just now. But the potential for an engineered food product with better bioavailability, a better nutritional profile that can be tailored to the needs of your different customer groups. Can you maybe describe for us the progress that's been made in the last couple of years? When would we potentially see things move into trials? And what do you see is the potential upside scenario of that technology being adopted in the high-protein platform?

Todd A. Becker - *Green Plains Inc. - President, CEO & Director*

Yes, that's a constant discussion that we continue to have with our partners and Novozymes happens to be one of them. And our partnership with Novozymes and others always would be beyond just protein concentrations. But in order to really start this new trial, we wanted to be up and running at multiple locations, so we have redundancy and we can make product for our customers at the spec we sold.

And so our next step is to really focus on the fact that our product contains 25% yeast. And if you look at the value, just the plain value of yeast today in the market, it's significantly higher than the value of protein. And so we are starting to work together to target that 25% yeast to express characteristics that is able to do that, whether it's amino acid or palatability or nutritional characteristics. We have work ongoing with our partners to go after those opportunities.

That's really where you make a step change in the value of this product where you can, again -- and we've been -- we're starting to see some results from early work that we've done and we're positive about those results. So we have a long way to go. But when you think about bioengineering yeast and the opportunities that are there, we already make a lot of yeast and we have a lot of fermentation capacity available. And so when you combine those 2 together and you put that into a formula, we believe really that's where we're going with this product.

It was never about making 50% protein. If that's all we did, it certainly would be a nice thing to do. But our value is going to come from making 60% protein and greater. But also the value is going to come from really bioengineering around the yeast and our partnership. That's the value of our partnership and what we're doing together with Novozymes and others. And that's where we think the real opportunity is going to come for our company.

Operator

Your next question comes from the line of Manav Gupta from Credit Suisse.

Manav Gupta - *Crédit Suisse AG, Research Division - Research Analyst*

So I think about a year or so ago, you guys had correctly predicted that eventually the renewable diesel markets will start pricing in the carbon intensity and the gap between soybean oil and corn oil will close. Now what we are seeing is that corn oil has started to move above soybean oil. So obviously, my question here is, do you expect that going ahead as over 2 billion gallons of new RD capacity comes on, most of it has some form of free treat, that soybean will trade at a discount to corn, so you have a premium product going ahead? That's the first question.

Todd A. Becker - *Green Plains Inc. - President, CEO & Director*

Yes, we've seen really a structural shift in the demand for distillers corn oil and what we produce, which is why we're so focused on making more of it, both through the -- ourselves through our own process improvements, use of the MSC protein system, which has another process improvement in terms of extracting and liberating more oil. And on top of that, we believe that there is some ability to separate some of that technology to even stand-alone and get more of that oil left in the kernel.

Remember, there's 1.8 pounds of oil per 56 pounds of corn, and if we are already achieving 1.2 to 1.3 relative to the 1.8, we're 2/3 of the way there and it's really -- the hard work begins now in liberating the rest of it.

To answer your question regarding pricing. We have really seen strength as a premium to soybean meal for distillers corn oil, even as high, as for some markets, over $0.10 a pound, that we've seen bids that high. Then it comes -- it's relaxing a little bit. But overall, we expect that as more and more -- as we double renewable diesel capacity this year as we get to late 2022, both benefits will accrue -- benefit will accrue to both soybean oil and distillers corn oil.

They're really -- if you take a look at the future of what's coming online, there really is a structural shortage of all, but there's definitely a structural shortage of low-carbon intense waste oils and waste stocks, whether it's fats -- animal fats or used cooking oil. And that's really where we're going to participate in, and that's what gives us confidence that -- if you just take a look at Green Plains, for our oil contribution margin alone, which is baseline $130 million to -- $140 million to $150 million a year right now, not inclusive of what comes out of the MSC system. You just take a look at that relative to the value of Green Plains alone, and that on its own front really starts to make our assets continually more valuable as we are the fuel for that opportunity to reduce your carbon intensity scores by producing renewable diesel.

So we're very excited about the opportunity, obviously. But if I was making soybean oil, I'd be just as excited about that opportunity as well.

Manav Gupta - *Crédit Suisse AG, Research Division - Research Analyst*

Perfectly clear. And my follow-up here is, I understand 4Q is in the rear-view mirror. We shouldn't focus on it. I just want to understand a little bit what kind of supply chain challenges you faced? Are those easing? So we can just get a little more confidence that in 2022, whether it's first half or second half, whatever happened in 4Q doesn't repeat. And I'll leave it there.

Todd A. Becker - *Green Plains Inc. - President, CEO & Director*

Yes. When we looked at our full year, and we went back and looked at it, if we would have been in the spot market every single day, we would have been within a $0.05 of gallon of the daily average crush for the year, not inclusive of obviously negative contribution from assets that were being modernized.

It really came down to these last 2 or 3 assets waiting for parts and actually waiting for a chip that was in short supply to run our DCS, our control system at Madison. Once that finally came, we are now ramping up Madison to full rates and we're making great progress there. The same thing happened at Mount Vernon, which we were replacing the dryer as it outlived its useful life.

And I think you're going to see more and more of that, which may cause disruptions in the U.S. fuel ethanol market because these assets are getting older and they are going to need to be upgraded, which is why we spent over the last couple of years capital on our own modernization programs.

Same thing with Mount Vernon. One side of -- one half of the dryer has started up this week. The other half should start up in the next 3 to 4 weeks. And we should be back up and running there in time for the start-up of MSC later in the year, because that's one of our protein production facilities that's being built, is in Mount Vernon, Indiana. A great location from a river standpoint. A great location from the southeastern demand standpoint.

So those should be behind us. Everything is on site that we need to accomplish this. Labor continues to be a challenge. We have seen escalation in costs of production across the industry and things like labor, denaturant and chemicals such as urea. But that's an equal opportunity cost increase. And so, overall, I think we're in better shape now to run in '22 than we were in '21.

And more importantly, in our York facility, where we have our specialty alcohol business, a bin collapsed. The bins were significantly old. Nobody was injured. We already stood up one bin replacement and the other one is being finished. And that should be mid-March when we bring that facility back full online. But we're running that at about 50% capacity, which negatively impacted the fourth quarter as well.

So overall, when we look forward, we're very excited about all of our opportunities in protein, oil, sugar and carbon, and a steady ethanol market would be another great outcome as well.

Operator

And our next question comes from the line of Adam Samuelson from Goldman Sachs.

Adam L. Samuelson - *Goldman Sachs Group, Inc., Research Division - Equity Analyst*

So Todd, I want to just maybe clarify just some of the pieces of '22, because obviously you gave some pieces on corn oil and the Hi-pro that you will be producing as increments. Obviously, those kind of all get rolled into the ethanol crush. And I'm just trying to make sure I understand what you're actually trying to -- how we should think about your -- the reported ethanol crush for this year. And I guess -- and even more specifically, in the first quarter, obviously, we've got very high corn oil prices. General ethanol crush margins have weakened considerably, just -- deviated meaningfully from spot market conditions based on hedging over the past year, good and bad. I'm just trying to make sure we're calibrated in terms of how that translates into actual ethanol crush in the first quarter or framing and what that all means from an reported ethanol crush for the year, because there's just a lot of moving pieces in the way you're talking about the different...

Todd A. Becker - *Green Plains Inc. - President, CEO & Director*

No, listen I'm... I'll be -- hopefully I can clear it up here, right? If you take a look at -- we start the year thinking -- as we said, we 0 base ethanol. Now -- right now, ethanol from a pure ethanol crush standpoint is negative. So we have to make up for some of that later in the year, and we think that's kind of how we started out last year as well.

But if you look at corn oil by itself, could contribute over $140 million. If you look at protein, stand-alone contribute between $40 million and $60 million. And obviously, our other businesses as well. And it's really going to come down to if ethanol is a minus 10 or a plus 10 or a minus 20 or a plus 50. I mean I think that's really what we're going to have -- we'll give you better clarity at the end of the first quarter on every component of achievement and we'll show you how every component worked through our process, what was the daily ethanol crush, what was our corn oil return, what was our protein return, what are our -- we're going to start to really show you the value as we accelerate that even a negative environment in the base crush, base ethanol margin we should still achieve positive results. And when ethanol is 0 or above, we should achieve extremely positive results.

And so that's really what we're setting ourselves up for. We're seeing it already. During the first quarter, as you look at the base margin while negative, when you add all things up together, it doesn't remain negative very long. And we're starting to see -- at this point, the market feels like it's hit a little bit of a bottom from the margin standpoint in terms of seeing a bid return into the market and the fact that there are significant supply chain issues around moving ethanol around the United States today. And we will probably get back into some market dislocations later into the quarter. And when you look at the incentive to blend ethanol, I think that will ultimately take shape as well.

But in the meantime, we started out weak during the quarter, but it looks like second quarter is starting to come back. And our view is that the base ethanol crush based on everything we know will return to positive. And then on top of that, you can add all these numbers for 2022.

Adam L. Samuelson - *Goldman Sachs Group, Inc., Research Division - Equity Analyst*

Okay. All right. That's a very helpful framing. And then if I could have a follow-up on the clean sugar as you start engineering work on the first system. Just to be clear, a, is there any capital associated with that in the way you thought about 2022 CapEx? I guess you won't fully know this until the engineering is complete. But on a per effective gallon of capacity, is there -- is it different than how you framed it in the past? I think it was about $1 a gallon how you framed it previously. And do the unit economics still look like they would match to how you've been talking about it over the last 12, 18 months or so?

Todd A. Becker - *Green Plains Inc. - President, CEO & Director*

Yes. We think that everything we said is basically what we're seeing today. That's why when we think about it, we're -- we could start out with a smaller plant, but obviously, CapEx per unit would be higher. So when we are looking at it, we think the best size plant is the equivalent of about 30,000 bushels a day. It could be plus or minus that. And engineering in the end, which is basically 30 million gallons of our equivalent production or about 3% of our production. That will produce about 400 million pounds of dextrose, clean low-carbon dextrose.

All of the economics right now that we're seeing thus far are consistent with what we said in the past, sub $1 per gallon equivalent CapEx and greater than $0.50 a gallon equivalent margins based on about $0.15 a pound dextrose versus our cost of production. And so when you take a look at that, we are very confident that the plan we have in place is a good plan to do our first unit.

We also have demand for our first unit. We're in discussions with several companies for potential colocation from renewable chemicals to synthetic biology to other opportunities that exist in the world today with companies that you probably have heard of. And so we strongly believe that the demand is there for this product and it's very deep today.

And also ours is a little different product. We're not -- we don't have to go to a fully refined clearer dextrose. We're leaving some minerals and other characteristics in it, which actually has turned to be beneficial for these producers. They don't want to buy the clear food-grade dextrose.

And so when we take a look at all of that and we look at what we accomplished in York and being able to make the product, we have great confidence that our first system will break ground in 2022 and it will be the beginning of what we believe is a revolution in our platform to start to look forward towards the future with clean sugar.

Adam L. Samuelson - *Goldman Sachs Group, Inc., Research Division - Equity Analyst*

Okay. And just to clarify. If there's a break ground later this year, is that in service by early '24? Or how -- what's the -- how long do you think that's going to take to come into service?

Todd A. Becker - *Green Plains Inc. - President, CEO & Director*

We think it's -- depending on the size of what we do, we think it's somewhere between a year and 14 or 15 months. So it's a late 2023 service if we can get it -- if we can get broken ground by the end of the third quarter of 2022, which is our goal. And we're making our site selection as we speak on which one of our sites we will do that at.

Operator

And our next question comes from the line of Ben Bienvenu from Stephens.

Benjamin Shelton Bienvenu - *Stephens Inc., Research Division - MD & Analyst*

So I want to ask about corn oil. You anchored your contribution from that product to $0.65 a pound. I think point taken and understood that the outlook looks quite bullish for vegetable oils and corn oil in particular. I want to get your view, though, on how much leverage you think the business has to higher corn oil prices with the idea that -- I suppose across the industry as the corn oil price goes up, it essentially lowers the breakeven price for ethanol. So I would think your kind of upside to price would be driven by your yield improvements more so than the absolute price. But I'm just curious to hear your thought process around how you think about dimensionalizing that.

Todd A. Becker - *Green Plains Inc. - President, CEO & Director*

I think when you take a step back and you look at the demand for the fuel today and demand for, in general, energy, around oil and RBOB and gasoline and globally, there's still a very good base demand for our product when the consumer drives and the consumer gets back to normal. And when we look at that -- on top of that, I think there's other opportunities that will come out of these alcohol products, whether it's in specialty or whether it's in ATJ and other things like that.

So while you can certainly make an assumption that -- and certainly the industry in the past has let it happen. Not everybody's corn oil yields are as high as others. But yes, certainly, some of that could be given back into the base unit economics of the crush. So far, we haven't experienced much of that yet. But I think ultimately, you have to have a healthy ethanol industry if you really want to have all that distillers corn oil to make significant margin in making renewable diesel. And I think the industry realizes that as well.

So I think -- that was the talk regarding different products that the industry makes. They'll just give it away. But I don't think necessarily that's the case. I think right now the weakness is really just driven by the weak consumer demand in the first -- in January, which is rebounding today. And then ultimately, there's still the issue around supply dislocations and supply chain movements with carriers and truckers.

So I think there's an opportunity still to not have to give that back away. Some of the leverage, you're right, is correct. When you take at an industry average of 0.7 or 0.8 pounds per bushel and all of our stuff we'll be achieving at our MSC plants, 1.1 to 1.3 or higher and then plus other opportunities to extract more oil, you can leverage yourself on that. But I don't think that's going to have to be the case. I think that the demand is so deep for low CI feedstocks in renewable diesel and it's going to get deeper that ultimately the industry doesn't have to give that away in the ethanol crush and they can realize all those economics and more.

Benjamin Shelton Bienvenu - *Stephens Inc., Research Division - MD & Analyst*

Yes. Okay. Makes sense. My second question just is around the phasing of Tharaldson. How do you guys expect that project to ramp and kind of where that is in the critical path of your priorities at the moment?

Todd A. Becker - *Green Plains Inc. - President, CEO & Director*

It's in a huge critical path of our priorities. We are just waiting for the ground to thaw, quite frankly. And when that ground thaws, we're going to get building. We're ready to mobilize. We have started to do some of that already. It's just a matter of winter and getting ready to -- we worked all winter to do some advanced work, because we knew that obviously it's hard to build up there. We're just waiting at this point. And we're -- engineering is ready to start and ready to go. In terms of what we've done so far, it's ready to start construction. And we are ready to build what will be the biggest plant in the United States producing the largest amount of ultra-high protein, also expanding their corn oil yields as well.

And we're very excited about what we're doing up there on the size, scope and scale in protein with our partners. And we expect to hopefully be completed with construction in 2022. But we want to make sure that depending on the weather -- when we complete construction, we may hold off starting that until it warms up a little bit. But if we can move faster, we'd like to at least try to get this thing running towards the end of the year. But it could take into 2022 to get -- 2023 to get that started up. Construction should be substantially complete this year.

Operator

Our next question comes from the line of Jordan Levy from Truist Securities.

Jordan Alexander Levy - *Truist Securities, Inc., Research Division - Research Analyst*

You've touched on a lot so far, but maybe more of a high-level question. Obviously, a lot of the volatility recently in earnings is coming from ethanol. I wanted to see if you could give us your thoughts on the -- as you go through this next phase of the transformation plan on the confidence that investors can have in not only the earnings ramp up, but the stability of the earnings ramp that comes with the transformation and the ability to mitigate some of the ethanol volatility that we've seen in the recent quarters as protein another initiative scale up?

Todd A. Becker - *Green Plains Inc. - President, CEO & Director*

Yes. As we get into 2023 and 2024 when our build should be completed and you start to produce 600,000 to 700,000 tons of protein per year, our base earnings from there will be we expect just at 50 pro -- and again, we're not going to -- we could talk about the higher proteins in a second --

should be still around $150 million a year just on base earnings as a comparable to whatever the high-protein soybean meal market is today. That's just the base earnings.

If you take your corn oil on top of that, of base earnings, and then you add those 2 together, I think you start right then and there over the total close to 1 billion gallons of production at $0.30 a gallon start. So whether ethanol is minus 10 or plus 10%, I think you start to accelerate away from ethanol economics because you have so many things that are available to you to push harder away from that.

If you increase your protein concentration to 60% and you take your first cut at $800 a ton as just a replacement for things like soy protein concentrate, you obviously from there can see a significant increase and another acceleration away from ethanol economics.

I think the ultimate acceleration away from -- still ethanol economics, as we covered protein and we covered oil, is really going to be around converting more and more away from alcohol and more and more into clean sugar. And we are gaining more confidence every day. And at that point, you completely divorce yourself from ethanol economics.

So 2022 could still be a volatile year. We know where we're going to get a certain amount of our base earnings from. We have to manage through the volatility of the underlying traditional ethanol margin, which I think we'll be able to do that during the year. And I think we are certainly seeing signs that the consumer is ramping up, is driving and gas demand, that the world is ramping up, driving in gas demand.

We've seen return of export interest for our product as well, and that would be very helpful as the U.S. consumer ramps up and the global consumer ramps up. The global consumer, other than traditional markets, have been somewhat exited from the U.S. ethanol export demand, and we're starting to see some of that come back at -- sitting at $0.65 under gasoline with another $1.20 RIN for our domestic consumers.

So overall, the fundamentals look actually solid. You've got to get out of the winter doldrums. And at that point, I think we're better able to manage our volatility. But come '23, we start to accelerate away from ethanol economics. And come 2024, we should be able to completely get away from those economics other than some slight volatility.

I think, Jordan -- just to close on that. I think -- just to close on that, Jordan. We have 3 under construction, 1 breaking ground. Our exit run rate and our entry run rate into 2023 is solid. We are fully in process and under construction at our 3 sites, and we'll continue to post updates on that. And also, starting to really bring on Wood River as we had a few extra bottlenecks we needed to fix. And even as early as next week, we should start to see the benefits of that.

And lastly, it's one of those: you build it and they will come. A lot of the bids that we saw for our product before we build it weren't real. They were just testing us. And now that we have product, actual product, we have significantly more demand than actually the product we make today. So we're very excited about that as well and we'll see where that goes during the next couple of quarters.

Jordan Alexander Levy - *Truist Securities, Inc., Research Division - Research Analyst*

That's a good segue into my next question on the protein side of things. Just wanted to see if we could get maybe some more details on some of the trials you've been doing with customers outside of pet and whether those have been supportive of sort of the J-curve profile you've talked to before and the uplifted value you've seen there? And yes, I'll leave it there.

Todd A. Becker - *Green Plains Inc. - President, CEO & Director*

Yes. We have done trials over the last year in almost all of the species, including beef cattle. We've seen some of our products go into that as well. And some of our post MSC. And we'll get into that in a second.

But look, we continue to see good results in aquaculture. We continue to see great interest in pet. By the way, we're expanding our pet customer base as we speak from everything from super sacks to full rail quantities as well. And so it's not just one of top -- one of the big 5 that are buying our product. It's really anybody that makes pet food today has an interest in our product. And so when you kind of look at that demand alone, that's at least a couple of MSC plants. And our product is the standard for what we're seeing in that industry. And we're starting to see more of the brands start to accept and include our product into pet. And that came through, again, palatability trials, ongoing trials. We're still in some more ongoing trials in pet to see what other uses there are.

And then when you look at things like poultry, we've even had trials in poultry and continue to do more and more. And it's a very good substitution protein, clean protein for that space. And what we're seeing at least in that industry -- and again, we're not feeding poultry today, but -- well, personally -- but we're starting to see the demand for clean proteins return, clean diets, because I think that, that adds a lot of value to the feed ration as well and we're seeing demand there as well.

And then when we get into swine, which is really the -- what we thought really wouldn't be the market that comes for this product, but we're starting to see really good demand out of the swine markets as well from piglets all the way through finishing rations. And that's actually the one that's a bit surprising, is that how well this product does in those markets as well.

So we have 3 innovation centers operating: one in Shenandoah doing aqua trials. And we're in the middle of a very large-scale salmon trial, where if any of you visited, you saw them, they were tiny. And now they're at least the size of a couple of handfuls. So they're getting bigger. And we're seeing great results so far. But again, there's a long way to go when you grow salmon.

And then in our York -- our Omaha feed innovation center has now fully opened. We're producing specialty feeds there as well and we have amazing technology there that we're sharing with our customers. And then our York Innovation Center, obviously, you've seen the results on clean sugar.

So while -- certainly, that's an investment we're making. Everything we're seeing across our 3 innovation centers and from our customers is saying that we just need to get these production facilities develop and running and the rest will take care of itself.

Jordan Alexander Levy - *Truist Securities, Inc., Research Division - Research Analyst*

Maybe I could just sneak one quick last one in. You talked to Aqua a bit. It's been a little while since we talked to Optimal specifically. I wanted to see your thoughts on how important this trial on 60 pro is to Optimal and what that could mean for the scaling of that business you have as well?

Todd A. Becker - *Green Plains Inc. - President, CEO & Director*

Yes. Optimal is a great -- Optimal Fish is a small business that does trophy ponds and largemouth bass and other things like that. Optimal Aqua is our brand regarding our commercial aqua feeds. And this 60 pro trial, we think, is a differentiation for them. They've been running trials with higher inclusion rates of the 56 and the 58 pro, looking to get their hands on more 60 pro. And we think that's a differentiation and a real value creator.

The substantive discussions we're in around aquaculture are really around formulation, diets, inclusions and production of commercial aquafeeds together with partners. And we think we're on the verge of some really exciting announcements there and are continuing to work towards those with our partners. So that is really -- once we get above 60 pro, that's when we really start to focus globally on getting our product included everywhere from Chile to Canada to Europe to Africa and to Asia.

Operator

Our next question comes from the line of Steve Byrne from Bank of America.

Stephen V. Byrne - *BofA Securities, Research Division - MD in Americas Equity Research & Research Analyst*

If your clean sugar technology is successful, what fraction of your ethanol capacity would you convert over to it? Is there a limit there? And if it's not all of it, do you have an interest in any of these developing technologies to convert ethanol to either gasoline or aviation fuel?

Todd A. Becker - *Green Plains Inc. - President, CEO & Director*

Yes. I think when you look at today what we know is that if we -- and we believe that the demand for clean sugar is going to double or more in the next 5 to 10 years -- 10 years. We will continue just to convert our own sites to produce more and more of the clean sugar product. And that's really what our plan is today.

Obviously, we can -- when you convert a site, you can toggle back and forth between dextrose and ethanol, whichever pays more, or dextrose and, say, alcohol-to-jet, whatever pays more. And I think that's really where our great optionality comes. The -- it's where the best earnings against that corn kernel happen. Our view is that it will happen in clean sugar first. And while it's happening in oil first, protein next, sugar after that and then potentially some of these new fuels. And beyond that, renewable chemicals are potentially going to be produced in our fermenters as well. So when you take a look at all of that, that's kind of the order.

I think today what's really important around ATJ is we are evaluating all the technologies. And you've seen announcements. Those are -- we don't believe today there's any exclusivity in any of those technologies yet. While there's certainly announcements of people that are adopting and companies are adopting, those technologies are available to others in the market today. But there's other technology sitting in the national labs. There's other technology sitting at other companies that we are also evaluating as well. It's still highly subject, in our view, to some of the government programs that you have to put in place to make it profitable. But some of them you're going to make potentially without some of those programs.

So I think it's about toggling to what the best outcome is and having the optionality to toggle what the best outcome is. And in order to obviously invest to make the new renewable jet, it's going to be a significantly more -- higher investment than making dextrose and clean sugar in our view.

So it's just a step process. But I think what it does, it illustrates not just for Green Plains but for this industry we are on the verge of rebasing the valuation of a dry mill facility to really have a lot more value than what the market is giving it credit for. And while we have close to 1 billion gallons, there's others with more and others with less -- this industry is on the verge of, I think, a revaluation and a rebasing, that while you may -- you want to deal with it -- you can deal with the monthly and quarterly volatility of ethanol economics, but you need to look past all of that and look at the base value of these assets as you look at protein oil, sugar, carbon as well as jet and other opportunities around chemicals. And that's really the future of this industry.

Stephen V. Byrne - *BofA Securities, Research Division - MD in Americas Equity Research & Research Analyst*

And I did want to follow up with you with one on renewable diesel. The outlook in the U.S., where increased production is certainly going to have a challenge pulling in feedstock, and you're seeing that already. And your comments are well taken about the demand outlook for soybean oil and corn oil, et cetera. My question for you is, do you see any risk here that there could be a glut of meal from all that increased crushing and having an impact on your protein initiatives?

Todd A. Becker - *Green Plains Inc. - President, CEO & Director*

Yes, I think that's a great question. And certainly, you have to look at that closely. Number one, the cadence of these bills is going to take a long time just to continue to build out more soybean crushing opportunities. But I don't think any of them that are building are worried about whether the world will be able to take all of that meal out of the United States.

I think there's a positive disposition even with additional soybean crush capacity in the United States that -- the world is shifting trade flows and Argentina is a bit of a mess. Will China be able to continue to buy whole soybeans or they're going to have to buy meal and switch policy there? I think the market is anticipating potentially there.

But in general, while certainly -- and I'm using -- I'm stealing a bit of a word. But you might have some lumpy years. But you're not going to -- ultimately, it will clear fast. We've always seen protein clear fast in the world. And from our standpoint -- yes, we're looking at it closely. But we service a different piece of the demand. And as we accelerate into higher protein concentrations with nutritional and biological characteristics, we think that we won't have that upon us.

But even if all that crush capacity gets built, which I think it probably will, and I would think the economics will remain very good for that industry for a long time. If you look at that capacity and what's going to come on, the cadence of it isn't fast enough, I believe, that's going to have any significant impact on soybean meal pricing. And if it did, I think you'd start to see that. But the market is accelerating on pricing this product because I think the world, as we open up, is not just a little short protein, but a lot of short protein. And I think COVID just put a pause on it. But now that the world continues to accelerate away from COVID, you see the resulting demand and price movements in protein.

Operator

Our next question comes from the line of Ken Zaslow from Bank of Montreal.

Kenneth Bryan Zaslow - *BMO Capital Markets Equity Research - MD of Food & Agribusiness Research and Food & Beverage Analyst*

Easy question. If your base case for protein is $125 million to $150 million, if you were to go to 60% pro, what does that actually translate to?

Todd A. Becker - *Green Plains Inc. - President, CEO & Director*

I think 60 pro, if you use just a -- look, we have a J-curve out there that certainly has high prices, but that's a long game. If you immediately say the first thing you're going to displace is an $800 a ton product, that is about a 30 to 35 ton uplift from traditional distillers grains and that's $300 million to $350 million uplift at 60 pro plus. It will take time to place all of that in the market and get that all into proper channels. But overall, that's the first place you would start to -- but you don't want to spend time there. I think you really want to go after the higher end, top end of that J-curve into displacement of things like -- you're never going to ever completely substitute fish meal, but I think there's opportunities to displace that in some diets with plant-based U.S. grown ingredients. I think that's starting to catch wind as well.

But I think if you just took a first look at $800 a ton. And then from there, obviously, every $100 a ton is another $60 million or so above that -- or $50 million to $60 million above that. So it's a huge opportunity for us. Again, it's long before we thought it was going to happen. It was a 3 to 5 year venture up on the higher proteins with our partner. And our view is we're going to get there a lot quicker than we thought. But then it's just going to take time to develop that market.

Kenneth Bryan Zaslow - *BMO Capital Markets Equity Research - MD of Food & Agribusiness Research and Food & Beverage Analyst*

Okay. I'm not that smart. So wait. So $125 million to $150 million was under 50 pro. I know you're going to go beyond the 60 pro, and I get that. But on the transition to that, if I would just use it as a benchmark, would that be $250 million? Would that be $200 million? Would that be $400 million? Help us out. What does that 60 pro mean relative to the $125 million to $150 million where you started out? And I get that it's going to go higher and -- but just to transition through that, what would that translate to for us who like it simple?

Todd A. Becker - *Green Plains Inc. - President, CEO & Director*

Okay. What that would translate to is that at $800 a ton, it adds somewhere between 30 and 35 tons of gallon, so somewhere between $300 million and $350 million base load earnings from 60 pro at the first cut. And then obviously, it goes up from there as you go into higher value markets, because you're still going to have limited amounts of this product. And we think we'll attract higher value markets than that ultimately, but it's not immediate because you have time to work through trials and rations and nutritionists and global trade flows and the rest of it.

But our first stop, we believe, is $800 a ton for that product and moving up from there as that product becomes more accepted and moves into different rations as well around the world. But it's an $800 to $1,200 ton opportunity, and our view is that somewhere in the middle of that we'll land on it for this product.

Kenneth Bryan Zaslow - *BMO Capital Markets Equity Research - MD of Food & Agribusiness Research and Food & Beverage Analyst*

So your $300 million to $400 million EBITDA base is starting to become marginalized, right? It's not really the real base anymore. Is that the way you're thinking about that $300 million to $400 million that you kind of put out there a while ago. Even just -- forget about the sugar for a second, the corn oil at $0.70 eventually. But even just with the Hi-pro moving, that base moves up substantially from where it is. Is that at least a fair statement?

Todd A. Becker - *Green Plains Inc. - President, CEO & Director*

That's why we're doing this every day and that's why we're focused on the Hi-pro. Again, it's -- your first -- much like when we made 50 pro, acceptance of the product, getting it into rations. And then once you get into rations, you start to see more interest and prices start to move, et cetera. I think the same thing will happen with 60 pro. We know where the first place that we're going to head and what we want to displace -- or actually expand potentially. And then from there, we'll just start to move up that value curve.

And that's -- nothing is immediate, but ultimately the value of protein is the value of protein and you start to realize the real value of protein. But yes, you are correct on those numbers.

Kenneth Bryan Zaslow - *BMO Capital Markets Equity Research - MD of Food & Agribusiness Research and Food & Beverage Analyst*

Okay. And then on the customer base that you have, what percentage are pet food, what percent are aquaculture? And then if you're looking a year from now, what will mix state? And I'll leave it there.

Todd A. Becker - *Green Plains Inc. - President, CEO & Director*

Yes. Because we only had really one plant plus one plant -- second plant online -- until we brought Wood River online, it was 100% pet, and we're still filling pet out of our Wood River facility. But also starting to see interest in things like poultry, dairy and swine.

So right now, it's well over 50% pet, but there is competition for that product. And as well as aquaculture is -- we're really not wanting to send this product into aquaculture today until we get over 60 pro, and then I think that transition will take place on customer when you look at customer percentages of sales.

So really, we're focused on this trial so that we can -- we've been patient, not wanting to send our 50 pro product into aquaculture channels, waiting to get to the over the 60 protein product -- 60% protein product.

Operator

Our next question comes from the line of Eric Stine from Craig-Hallum.

Eric Andrew Stine - *Craig-Hallum Capital Group LLC, Research Division - Senior Research Analyst*

I'll just sneak one in here at the end, just on carbon capture. Definitely hearing more shatter just about some issues regulatory-wise, permitting at the state and local level. Just curious if that changes the outlook there. I think previously, it seems like the pipeline and the 8 were probably first. I mean I know this is still longer term, but first. I mean, does that outlook on the permitting side potentially move the direct injection opportunity ahead of the pipeline opportunity?

Todd A. Becker - *Green Plains Inc. - President, CEO & Director*

No, I think they're tracking really -- probably tracking more towards the pipeline still. They're making great progress and we're very happy with what Summit's doing. They're starting to already get right away. They need -- obviously, they're going through the permitting processes in each of these states. And thus far, while -- yes, you certainly read the headlines about -- what's really happening is I think the states want the project. And the customer -- when you get right-of-ways -- we're not -- Summit is not showing up as a traditional pipeline company. This is really when you look at it, and who's on, who's shipping on this pipeline, this is an agricultural farmer-backed project. And that's really what resonates about the Summit Carbon pipeline as you look at permitting and right-of-ways through farmer and U.S. farmers' land.

When you think about who's showing up at the door, it's somebody very highly invested in agriculture. And I think when you put all that together -- yes, certainly, you want to make sure, obviously, all your permits are in place. But thus far, I would say Summit is tracking really well to where we thought they would be at this point and we have confidence that they'll continue to do that.

Obviously, you have to assess the risks around: Is there extended time for permitting? But even with that said, I just can't imagine that any of these states don't want to have this massive awesome project run through their states to help obviously clean up the environment regarding the fermentation CO2, et cetera. So we're very comfortable where they're at today.

If you look at our other opportunities -- direct inject is only one of many opportunities with carbon. There are other carbon technologies out there that don't necessarily have to go to direct inject, where you capture them and produce other products. And we're evaluating those as well and we're in discussions on opportunities there.

So I think this carbon story is still very early days and certainly we committed early to a pipeline. But if you also think about the use -- the highest and best use of carbon for us at Green Plains is to make clean sugar. Because clean sugar, you don't emit carbon anymore. And the value of that combined -- in the product is higher than most other opportunities in carbon with a lot less risk because you're keeping the carbon from the corn kernel in a product.

So if you think about what ethanol does every day, 1/3 of that kernel is just not valued at all, it goes up to stack. If you make clean sugar, you now reused 1/3 of that kernel, which is the -- carbon -- when you make a sugar molecule, carbon is part of that and you're no longer emitting carbon into the atmosphere. So I think our ultimate plan on carbon at Green Plains is to be able to flex and make clean sugar as well.

Operator

And our last question comes from the line of Laurence Alexander from Jefferies.

Laurence Alexander - *Jefferies LLC, Research Division - VP & Equity Research Analyst*

2 quick ones. On the dextrose, how long after the facility is in service do you expect to hit -- be able to validate normalized pricing? And secondly, with Fluid Quip, can you give an update on your licensing strategy and maybe some sense of where licensing revenues could get to in, say, 3 to 5 years?

Todd A. Becker - *Green Plains Inc. - President, CEO & Director*

Yes. Our view is normalized pricing will happen pretty quick with regard to CST. We are in discussions with multiple potential colocation and end-use opportunities. And they know what the product is going to look like already and they've used the product in their own production in terms of whether it's on the bench or whether it's in pilot. And it matches all the characteristics and more of what they have bought traditionally or going to buy traditionally.

So our view is that this one will be a little bit easier because the price of this product is pretty -- is well defined and all we have to do is produce it. And we actually think there'll be campus opportunities -- we'll call them campus opportunities -- where some of these partners that we're looking at on supplying them dextrose will pull -- will colocate at this first facility potentially in the future as well. So at that point, there's other opportunities.

So we're excited about that. I think that the product we have and the technology and the IP around this product, we continue to get more and more -- 2 of those 7 patents last year were around clean sugar. And we're going to continue to lock that down and button that up. And I think that's really where the real value for Fluid Quip is.

Fluid Quip as a stand-alone -- when you take a look at that company ultimately, as we build out our process, it's not -- it's a little early days for that. But just the value of the IP, from protein to oil to clean sugar and beyond and what's needed in the world of the bioeconomy, the value of the Fluid Quip portfolio and the potential licensing opportunities are certainly great. But remember, we own this technology. We don't buy technology anymore. And we need to make sure we monetize the ownership and the opportunities around this technology.

I'll just close with one thing. As we think about Fluid Quip as protein, oil, and sugar -- and I think it's a great way to think about it and the IP around that. We will protect that IP and we continue to bolster our positions. The world -- when you think about the future of the world in synthetic biology and biochemicals and green biology and bioplastics and all the rest of it, how does it all happen? It happens in a fermentation vessel that's fed by clean sugar and it drops -- the solids drop out and no solids need to get separated.

And the -- what we believe is the large -- one of the largest scale separation and best separation technologies in the world outside of protein, and what we're doing is the Fluid Quip technology. If you want to talk about the real opportunity around that, is that as we move -- as you know, specifically, as you move into the bioeconomy, it's going to take significant investment in separating all of these different chemicals or ingredients or biological components that all have to run through separation. And we believe that Fluid Quip on a separation technology alone has an incredible opportunity ahead of them as well, because that's what we do today with our protein and our stillage, but you could do it with many other types of products running it through the Fluid Quip system. So I think licensing strategy is part of it, but I also believe the technology deployment is just as valuable, if not more.

Operator

Thank you. I'm not showing any further questions in the queue. I'd like to turn the call back over to Todd for any closing remarks.

Todd A. Becker - *Green Plains Inc. - President, CEO & Director*

Yes. Thanks, everybody, for coming on the call. Obviously, a lot to talk about, a lot of exciting opportunities ahead of us. We're standing up our systems. We're standing up our strategy. We're moving into the next phases of our strategy. And we believe that we possess great technology to do that and we've derisked a lot of that as we're going to make that investment into our next phase of rolling out technology that's very valuable to our platform.

When you look at the total Green Plains today and you look at the solutions that we have and the opportunities that we have, I believe that the times ahead of us are going to be very exciting and exciting for our shareholders because we're going to continue to prove that the value of our assets are going to continue to go up. But more importantly, the value of our IP and our technology portfolio is significantly undervalued relative to the long-term opportunity at the company. And we'll continue to execute.

And this is an exciting year for us. We have base load earnings and we're going to continue to grow those base load earnings as we go into '23 and '24.

Appreciate you jumping on the call today, and we'll talk to you guys next quarter.

Operator

And this concludes today's conference call. Thank you for participating. You may now disconnect.
