APPLICATION CHECKLIST

Use this checklist as a tool to ensure that you have all of the components of the application package. Please note, this checklist is for your use only and does not need to be included in the package.

☒	Application
☒	Transmittal Letter
☒	$100 Application Fee
☒	Tax Liability Statement
☐	Letters of Support (If Applicable)
☒	Other Appendices (If Applicable)

When the package is completed, send an electronic version to Ms. Karlene Fine at kfine@nd.gov, and 2 hard copies by mail to:

Karlene Fine, Executive Director
North Dakota Industrial Commission
State Capitol – 14th Floor
600 East Boulevard Ave Dept 405
Bismarck, ND 58505-0840

For more information on the application process please visit:
http://www.nd.gov/ndic/renew/info/submit-grant-app.pdf

Questions can be addressed to Ms. Fine at 328-3722, or Andrea Holl Pfennig at 328-2687.

Renewable Energy Program

North Dakota Industrial Commission

Application

Project Title:

Barley Protein Concentrate

Applicant:

Midwest AgEnergy Group

Principal Investigator:

Jeff Zueger

Date of Application:

May 24, 2018

Amount of Request:

$83,810

Total Amount of Proposed Project:

$167,620

Duration of Project:

4 Months

Point of Contact (POC):

Adam Dunlop

POC Telephone:

701-442-7503

POC Email:

adunlop@midwestagenergy.com

POC Address:

2841 3rd Street SW

Underwood. ND 58576

TABLE OF CONTENTS

Please use this table to fill in the correct corresponding page number.

ABSTRACT

Objective:

Midwest AgEnergy Group (MAG) is requesting financial assistance from NDIC to advance our efforts in using ND barley to produce a high value protein concentrate designed for aquaculture and a low carbon advanced biofuel. MAG has a business relationship with Montana Microbial Products (MMP) which currently operates a pilot plant utilizing a patented process to produce Barely Protein Concentrate (BPC). The intent of this project is to demonstrate the feasibility of scaling up the technology owned by MMP and integrating it into the Dakota Spirit AgEnergy (DSA) Biorefinery owned and operated by MAG.

The first phase of this project will provide a market analysis of protein feed ingredients in aquaculture, an analysis of barley availability as a feedstock in ND, completion of Front End Engineering and Design (FEED) and integration opportunities, and development of an understanding of the regulatory requirements necessary to move forward with construction/operation.

Expected Results:

MAG has performed internal due diligence on the feasibility of this project and believe it has great promise. We are instituting a stage gate process towards the addition of a Barely Protein Concentrate (BPC) as commodity produced by MAG. The first phase of the study will:

1. Study the supply and costs of feed barley grown in ND and confirm its availability as a feedstock into protein concentrate and advanced biofuels is feasible.
2. Study the market opportunity for barley protein concentrate in aquaculture. Determine the size, scale, logistics, and dynamics of the aquaculture market.
3. Perform engineering study to determine integration feasibility and design equipment specifications leading to a +/- 30% cost estimate.
4. Determine if production of an advanced biofuel is likely given the engineering study and set course for achieving required EPA or other regulatory approvals.

Duration:

The FEED study is expected to be critical path for this phase of the project. We expect 10 weeks for this to be completed once approval is given to the engineering contractor to move forward.

Total Project Cost:

$167,620

Participants:

Midwest AgEnergy Group, Dakota Spirit AgEnergy, ND Barley Council, Montana Microbial Products, Fluid Quip Process Technologies, and Eco-Engineers.

PROJECT DESCRIPTION

Objectives:

Advance efforts in using ND barley to produce a high value protein concentrate designed for aquaculture and a low carbon advanced biofuel. MAG has a Letter of Intent with Montana Microbial Products (MMP) which currently operates a pilot plant utilizing a patented process to produce Barely Protein Concentrate (BPC). The objective of this phase of the project is to demonstrate the feasibility of scaling up the technology owned by MMP and integrating it into the Dakota Spirit AgEnergy (DSA). We will also determine the feasibility of securing barley meeting the quantity and specifications required and analyze the market potential for advanced biofuel and barley protein.

We intend to manage this project in multiple phases. The first phase of this project will provide feasibility information about the market and process design. The second phase will be comprised of detailed engineering and additional market discovery as detailed below. This grant application applies only to phase one. Objectives include:

1. Perform a market study on the availability of feed or high protein barley in the geography of the proposed processing facility.
2. FEED study to determine optimal integration strategy and obtain +/- 30% cost estimate.
3. Market analysis of Barely Protein Concentrate and advanced/low carbon biofuel.
4. Identify regulatory approvals necessary to produce and market these products.

Upon satisfactory completion of objectives of phase 1 we intend to move forward with the second phase of the project which will include:

1. Detailed barley origination program development.
2. Detailed Engineering and Design completion.
3. Securing key marketing partners or offtake agreements for BPC and advanced biofuel.
4. Applying for/obtaining EPA RFS approvals and Low Carbon Market certifications

If studies do not reveal fatal flaw, the intent will be to move directly into construction upon completion of Phase 2.

Methodology:

***Barley Feedstock Study*:** We will conduct studies to determine the current and projected supply of barley feedstock in the area adjacent to our facility to supply our process. Inherent to the study, we will first isolate the desired end-use characteristics of the barley we seek and relate those to quality specifications we will set as purchasing standards. Components of our feedstock study will be:

- Production history for barley in ND
- Historical consumption demand for barley from food, feed and malting industries
- Prices paid for feed and malting barley
- Comparison of crop production budgets and cash flow margins for barley vs. other major crops in ND
- Analysis of transportation and storage resources required for ongoing supply of feedstock

***Front End Engineering & Design*:** Engineering design basis work required for scale up of pilot plant and the process of integrating BPC into an existing ethanol facility. The new BPC equipment and systems are to produce approximately 15,000 to 25,000 tons of BPC and 5.76 to 9.60 million gallons of ethanol by processing about 3.85 to 6.42 million bushels of 14.5% protein barley.

The scope will include design specifications for all equipment and system integration needed to receive, de-hull, mill, slurry, hydrolyze, liquefaction, ferment, distill and dehydrate feed grade barley to produce fuel grade ethanol meeting the applicable ASTM standards. As well as design required to separate, centrifuge, dry, store and loadout BPC meeting the required feed characteristics. Additional products may be barley hulls, and low solids stillage.

For optimal integration additional information may be required to properly design and size process equipment. The engineering contractor shall help determine the scope and type of testing to be performed at the Iowa State University ethanol research and development test facility or other such pilot facility.

***Products Study*:** We will also analyze the market for the finished products of our process. We will be producing a unique new feed product that has an optimum nutritional profile and superior palatability characteristics for aquaculture diets. We will also be producing fuel ethanol that we believe will be classified as a low carbon/advanced ethanol product as defined by EPA and state/provincial regulations. Our first phase market analysis will include:

- Global and national analysis of aquaculture feed demand prospects
- Determine market niches for BPC and projections for demand
- Analysis of alternative protein feeds price/value
- Estimate of BPC relative value in aquaculture feed market.
- Price correlation studies between barley and other protein products
- Estimate carbon intensity score for barley process
- Project market price differential for low carbon/advanced ethanol

***Regulatory Approvals*:** The requirements to produce advanced biofuels are generally understood. Barley is a feedstock that qualifies to produce advanced biofuel if the lifecycle achieves 50% GHG reduction versus the petroleum baseline fuels. Discussions with the EPA are anticipated to better understand the process and information required to submit a pathway for advanced biofuel from barley. A detailed application cannot be prepared until the FEED and possibly the detailed engineering design are complete.

Aquaculture feed product approval process will be studied to determine if specific FDA or other types of regulatory entities must grant approvals, permits, or certification to produce feed ingredients for aquaculture.

Anticipated Results:

Barley Feedstock: Anticipate confirmation that ND is suitable location for sourcing feed barley in the quantity desired at a price that will be conducive to processing.

FEED will determine:

1. Integration bottleneck areas identified and characterized
2. Process Flow Diagrams of BPC and integration with DSA from barley receiving to finished products
3. Mass & Energy balance of BPC and integration impacted areas
4. Ingredient assumptions and considerations
5. Site water balance demonstration
6. General Arrangement Drawings
7. Major equipment list with capacities and design considerations
8. (+- 30%) Cost estimate for equipment and installation of equipment
9. Required utilities and an assessment of existing utility capacities to meet these new needs. To include water, steam, electricity, cooling water, natural gas

Products Study: Growing global demand for the BPC product. Sustained demand for advanced biofuels.

Facilities:

The desired location for integration is the DSA Biorefinery near Spiritwood ND. MMP pilot plant which will be referenced for design is located in Melrose MT.

Resources:

Barley Feedstock: We will enlist the aid of the ND Barley Council, University Ag Economics departments, and private consulting firms to supplement our in-house research.

Engineering and design: Fluid Quip Process Technologies, MMP Pilot Facility, Iowa State University BioCentury Research Farm.

Product Study: Resources for the BPC studies will feature Dr Rick Barrows, founder of Aquatic Fed Technologies, LLC and lead researcher in developing BPC. We will also draw on the experience of MMP, private feed nutritionists, feed dealers and brokers.

Regulatory: Eco Engineers, NDDH, EPA, California Air Resource Board and others on feed ingredient study.

Techniques to Be Used, Their Availability and Capability:

The processing technologies to be deployed are existing and available in various other industries. Dehulling, milling, and fermenting barley has been successfully demonstrated in multiple ethanol plants. The techniques utilized to concentrate the barley protein have been proven out in the MMP pilot facility. Scaling and integration of “bolt on” technologies is one of the core areas of expertise for the engineering contractor.

Environmental and Economic Impacts while Project is Underway:

Phase 1 is not believed to have environmental impacts. Further phases will have contribution to the local economy through construction. Broader economic impacts are expected if additional acres of barley are required to produce adequate feedstock.

Ultimate Technological and Economic Impacts:

Our product is developed to be uniquely adapted to the diets of high value carnivorous fish like salmon and trout. BPC exhibits superior palatability, nutrient digestibility, and lack of anti-nutritionals making it an excellent aqua cultural feed ingredient. BPC's nutrient efficiency results in higher water quality from much reduced phosphorus in fish waste. This is essential to maintaining a healthy growing environment in closed production systems and significantly lowering phosphate levels from flow-through farming systems. BPC can also reduce the cost of aquaculture feeds. Fish meal prices have consistently traded considerably higher than $1,000/ton in the last five years, due to the developing scarcity of wild caught forage fish. BPC may be able to reduce the fish ration cost and raise better, cheaper fish protein.

While final numbers are not yet available, construction costs are expected to be in the $15-$30 million dollar range. The construction will take several months and supply jobs to skilled laborers. This will have significant economic impact of the communities that surround the proposed location.

Why the Project is Needed:

At a local level, this process will help revive demand for an important ND crop. Barley production in ND averaged 89 M bushels in the five year span between 2000 and 2004. The most recent five year average was 43 M bushels. Last crop year, ND produced only 25 M bushels of barley and fell from perennial first place status in US production to third place. Barley has been raised primarily for malting purposes. Changes in consumer preferences have hurt demand for the most popular malting barley types developed for ND soils and climates. Demand continues to falter. Cargill announced in March 2018 that they will discontinue operations and shutter their barley malting plant at Spiritwood, ND in response to the shift in barley demand. Our business model brings demand to ND that may help change the dark prospects for ND barley growers. Our process does not demand a particular barley type. The quality specifications we value include higher levels of protein. This allows farmers to fertilize their barley crop for maximum production and kernel fill without the fear of their crop being rejected for excess protein. Raising barley allows growers to break crop disease and weed pest cycles through rotation. We intend to offer a price premium to feed barley to secure the quality and quantity of barley needed for our process. In the heyday of ND barley production, Stutsman and Barnes counties were among the top barley producing counties in ND. Now, even with a maltster located in their center, barley is a minor crop in Stutsman and Barnes counties. With the prospect of growing more barley for a premium price we believe we will see revitalization in local barley production.

Aquaculture is rapidly growing as a supplement to and potentially a replacement for wild caught fish protein for the human diet. Commercial aqua culturists have found themselves in competition with wild fish populations for the same resource: forage fish. This is besides the traditional harvest of forage fish for feed and commercial uses. The harvest of forage fish like anchovies, menhaden and herring has plateaued in recent years despite larger more sophisticated capture technology. This also creates a limit on the harvest of wild species feeding on the ocean's forage base. The forage fish base is in danger of overfishing and is now being regulated by governments in an effort to stem overfishing. The incorporation of BPC into carnivorous fish diets, with proper supplementation, has the potential to entirely replace fish meal in aqua feeds. This is an important development to world nutrition. Fish are more efficient converters of feed into protein compared with livestock and poultry. Fish is also the protein of choice for many of the world's hungry populations. MMP has successfully operated their pilot facility for over one year continuously to provide BPC to their business partner for a large scale fish feeding trial. The trial demonstrated that concentrated protein from terrestrial plant can displace fishmeal in aquaculture diets.

The renewable fuel standard set aggressive goals for the production of advanced and cellulosic ethanol. In 2017 the statutory renewable volume obligation (RVO) was for 9 billion gallons of advanced biofuel but due to the lack of availability EPA set the mandate at 4.28 billion gallons. In 2018 the statutory RVO for advanced biofuel was 11 billion gallons with EPA setting mandate at 4.29 billion gallons. This trend is expected to continue with mandated renewable fuel volumes not being commercially available. We believe this project will provide an advanced biofuel at a cost competitive with traditional biofuels.

STANDARDS OF SUCCESS

Standards of Success should include: The measurable deliverables of the project that will determine whether it is a success; The value to North Dakota; An explanation of what parts of the public and private sector will likely make use of the project's results, and when and in what way; The potential that commercial use will be made of the project's results; How the project will enhance the education, research, development and marketing of North Dakota's renewable energy resources; How it will preserve existing jobs and create new ones; How it will otherwise satisfy the purposes established in the mission of the Program.

Standards of success of this project will be delivery of the items noted in phase 1, items 1-4 in the objectives section of this application. Ultimate success of this project will be measured in the production of advanced biofuel and high protein aquaculture feed product in the quantities determined in the feasibility study.

Benefit to the state of ND will be created through processing of barley into a higher value product in state instead of simply exporting bushels of barley. The demonstration scale anticipates processing between 3.5 and 6.5 million bushels of barley. Instead of exporting that volume of barley (or similar volume of another crop) we would be processing it into higher value products such as 5-10 million gallons of advanced biofuel and up to 25,000 tons of protein concentrate.

Soil scientists have indicated the James River Valley area had increasing soil salinity over the last decade due to the increasing growth of row crops. Barely is a great crop to return to the rotation as it can thrive in higher saline soils and actually help to improve soil quality. A local outlet for barley could help return cropland to higher productivity in years it is not planted to barley.

The private sector is likely to benefit from new jobs in construction of the protein plant and transporting the finished products. Support services should see increased traffic through their businesses as a result of the project. The public will benefit from the license fees off the transportation vehicles, fuel taxes associated with keeping the feedstock and products moving and ultimately from higher usage of a cleaner and sustainable motor fuel.

MAG stands to benefit through diversification of revenue streams from that of a typical first generation corn ethanol plant. Currently, the Renewable Fuel Standard (RFS) has requirements for increasing levels of advanced biofuel that are currently not being achieved. The lifecycle carbon intensity of barley ethanol is also likely lower than traditional corn ethanol allowing premium pricing in locations with low carbon liquid transportation fuel requirements. The addition of aquaculture feed ingredient to products produced by MAG has potential to have higher average margin opportunities than the products produced today. This diversification will preserve the jobs and potentially offer advancement for MAG employees working in the manufacturing facilities.

BACKGROUND/QUALIFICIATIONS

Please provide a summary of prior work related to the project conducted by the applicant and other participants as well as by other organizations. ***This should also include summary of the experience and qualifications pertinent to the project of the applicant, principal investigator, and other participants in the project.***

We are licensing the technology from **Montana Microbial Products** with their commitment to assist in the commercialization of their technology. They will have a financial interest in the success of our business model. They have taken this technology from the lab bench to a pilot scale production plant. They have produced and supplied product to one of the largest freshwater fish producers in the US, who have conducted a real world one-year test of BPC. MMP has completed application with the Association of American Feed Control Officials (AAFCO) for a unique feed ingredient definition designated Barley Distillers Protein Concentrate (BDPC) for aquaculture labeling.

Dr. Rick Barrows is a world renowned Fish Physiologist working with the USDA/Agricultural Research Service in Bozeman, MT. He also founded Aquatic Feed Technologies, LLC to assist companies in feed ingredient development and regulatory approval. He has been an active in helping MMP develop and refine the BPC product for fish and pet diets. Dr. Barrows has conducted multiple independent trials to document the performance of the BPC product manufactured by MMP. Dr. Barrows is available to us as a consultant in moving this process from the demonstration scale production to full commercial rollout.

Midwest AgEnergy Group, LLC has successfully developed two bio refineries in ND. Blue Flint Ethanol located at Underwood, ND and Dakota Spirit AgEnergy at Spiritwood, ND. MAG commenced operations in 2007 and has produced over 800 M gallons of ethanol refined from ND corn. Our businesses are recognized as technological leaders in the biofuels industry, starting with our innovative Combined Heat and Power plant design which utilizes steam from co-located power production facilities. Blue Flint has the lowest carbon score of US ethanol exporters to western Canada. Dakota Spirit is among the most carbon efficient ethanol plants supplying ethanol to California. As leading operators in our industry, we have access to technologies such as BPC which promise to unlock new markets for North Dakota's existing resources.

Fluid Quip Process Technologies, LLC® (FQPT) was founded on the experience and knowhow within the agriculture and grain processing (corn wet milling) industries. FQPT, founded in 2012, is headquartered in Springfield, Ohio, with its key engineering and project management teams located in Cedar Rapids, IA. Its roots, history and experienced management team has been working in and developing new technologies, system and equipment tied the dry grind biofuels and biochemical markets for more than 25 years. FQPT's extensive process engineering and design team consist of 15 Chemical Engineers and 3 Mechanical Engineers and an extensive CAD team.

FQPT started as a development and enhancement technology company for the corn dry grind ethanol industry and has since branched out to providing a complete set of engineering and project management services not only for FQPT derived technologies, but for other 3rd party bolt-on technologies. FQPT services include:

- Technology Development and Implementation
- Innovative Solutions
- Technology Vetting
- Process Engineering
- Plant/Process Optimization
- Energy Enhancement Projects
- Mass and Energy Balance
- Project Management and Construction Services
- Greenfield/Brownfield Projects
- Plant Expansions

FQPT has developed multiple patented and patent-pending technologies as well as licensed additional commercially proven technologies geared towards enhancing the base corn-to-ethanol dry grind process and the growing Biochem carbohydrate market. In total, FQPT has 29 of its commercial technologies operating at 23 different biofuels facilities worldwide and more in various stages of commercialization.

MANAGEMENT

*A description of **how** the applicant will manage and oversee the project to ensure it is being carried out on schedule and in a manner that best ensures its objectives will be met, **and a description of the evaluation points to be used** during the course of the project.*

The project is set up in multiple phases with checkpoints along the way to ensure the objectives are met or are achievable before moving on to next phase. Since phase 1 is primarily a series of feasibility studies the evaluation is set to occur once all of these evaluations are complete. If a fatal flaw is discovered during any of these investigations the project may be terminated or revised. At the completion of phase 1 the existing financial model will be revised to include updated capital expenditures, feedstock procurement, and market prices for biofuel and BPC. If the return on project still meets our threshold we intend to move to phase 2 of the project.

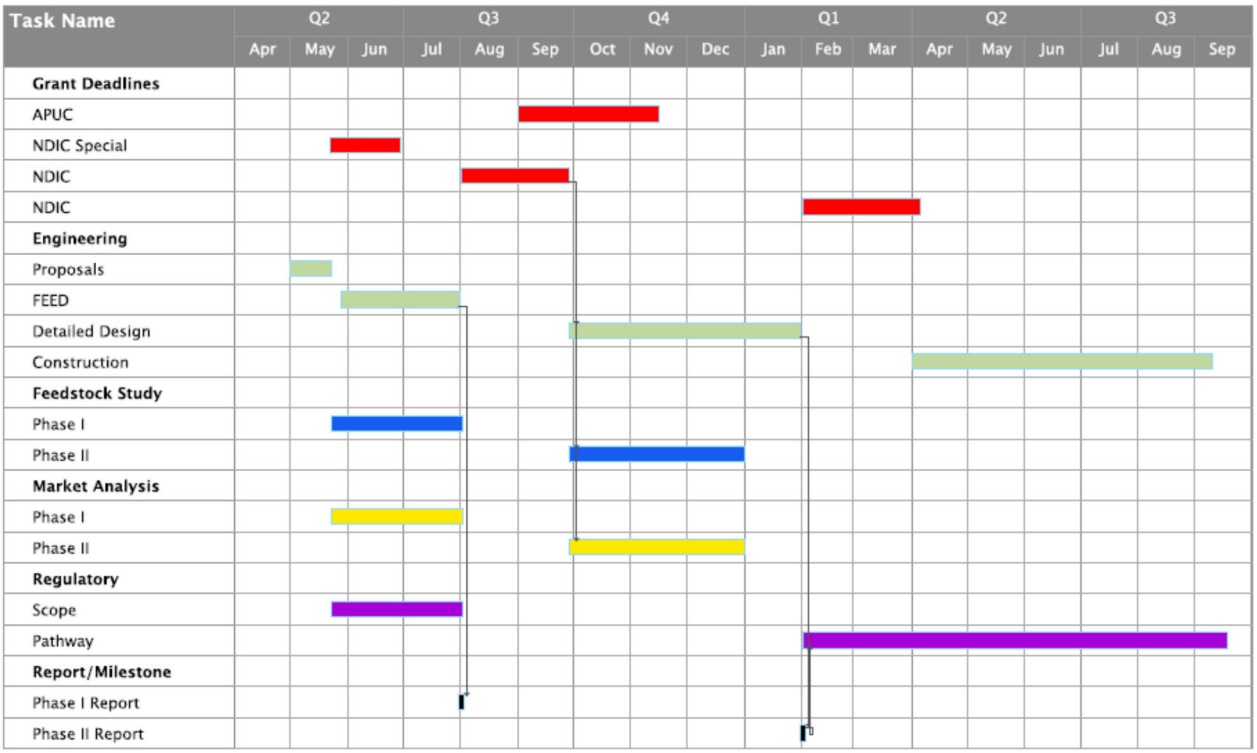
An estimated timeline for project activities, reports and decisions points is provided in the timetable section below.

TIMETABLE

Please provide a project schedule setting forth the starting and completion dates, dates for completing major project activities, and proposed dates upon which the interim reports will be submitted.

The Engineering and Design timeline is critical path to keeping project on track as illustrated. The opportunity for special grant timeline in conjunction with MAG assuming risk of starting project prior to the determination of grant is critical to achieving interim report prior to Aug 1, 2018. If the stated objectives are achieved and the project continues to look viable we anticipate submitting application to NDIC for certain components of Phase 2.

MAG Barley Protein Concentrate



BUDGET

*Please use the table below to provide an **itemized list** of the project's capital costs; direct operating costs, including salaries; and indirect costs; and an explanation of which of these costs will be supported by the grant and in what amount. The budget should identify all other committed and prospective funding sources and the amount of funding from each source. **Please feel free to add columns and rows as needed.** Higher priority will be given to those projects have matching private industry investment equal to at least 50% or more of total cost.*

Project Associated Expense	Total Cost	NDIC's Share	Applicant's Share (Cash)	Applicant's Share (In-Kind)	Other Project Sponsor's Share
FEED Study FQPT	$ 107,500.00	$ 83,810.00	$23,690.00		
FEED Study MMP	$ 12,000.00				$ 12,000.00
FEED DSA Engineering	$ 2,720.00		$ 2,720.00		
Barley Market Study	$ 20,000.00		$17,000.00		$ 3,000.00
BPC Market Study	$ 20,400.00		$18,000.00		$ 2,400.00
Regulatory	$ 5,000.00		$ 5,000.00		
Project Total	$ 167,620.00	100%			
NDIC Total Request	**$ 83,810.00**	50.0%			
Applicant Cash Total	$ 66,410.00	39.6%			
Sponsor/Applicant In-kind Tot	$ 17,400.00	10.4%			

Please use the space below to justify project associated expenses, and discuss if less funding is available than that requested, whether the project's objectives will be unattainable or delayed.

The largest direct cost for phase 1 is the front end engineering and design cost. The proposal from Fluid Quip is attached in Appendix A. MAG is providing direct payment to FQPT for engineering study and intends to utilize grant monies for a portion if approved. MAG will be taking the lead on the feedstock study, marketing study and regulatory study with assistance from subject matter experts in various fields. Investments of labor from key staffers at MAG are shown as applicants share in cash. Staff hours allocated to this project will be tracked and total compensation considered when calculating the cash value. Conservative estimates were used for the purposes of the budget. We assumed 85 hours for barley study, 90 hours for Market study, 25 hours for regulatory study and 40 hours of DSA engineering needed to complete phase 1. We expect to be able to provide letters of commitment from the partner entities MMP, ND Barley Council, and Dr. Rick Burrows describing their expected contributions to the project. For the purposes of the budget we have estimated 80, 20, and 12 hours resulting in $12,000, $3000, and $2400 respectively. Additional In-Kind resources may be added to the project depending on availability of partners and actual time required to complete the tasks. This may decrease the MAG cash contribution if fewer hours than anticipated are allocated to project.

CONFIDENTIAL INFORMATION

Any information in the application that is entitled to confidentiality and which the applicant wants to be kept confidential should be placed in an appendix to allow for administrative ease in protecting the information from public disclosure while allowing public access to the rest of the application. Such information must be clearly labeled as confidential and the applicant must provide the following information. <u>If there is no confidential information please note that below.</u>

Certain financial components of the marketing and feedstock availability study are expected to be proprietary to MAG and detailed results impacting the business model will not be shared in public reports. Information regarding feasibility of project will be shared as part of the reporting process.

As indicated below the BPC process is currently held under patent. Engineering details deemed specific to the patent are considered proprietary. Status and feasibility of integration into an existing ethanol production facility will be shared in the reporting process.

For ease of processing we will provide confidential information in report appendixes.

(a.) a general description of the nature of the information sought to be protected: Information that is related the business model, financial projections, markets and customers, technology that could be considered intellectual property and all trade secrets.

(b.) an explanation of why the information derives independent economic value, actual or potential, from not being generally known to other persons: Barley Protein Concentrate does not exist in large form in the market today and we intend to develop an integration design which we will have the ability to consider patentable. The market data will be unique to this product and we will want to protect it for internal use to our companies use given our exclusive North American license agreement with MMP.

(c.) an explanation of why the information is not readily ascertainable by proper means by other persons As above, this product does not exist in any scale in the market today.

(d.) a general description of any person or entity that may obtain economic value from disclosure or use of the information, and how the person or entity may obtain this value: Commodity processors, Feed marketers, competing technologies, potential customers by knowing our business model, production methods, cost structure and market strategy would put us at a disadvantage to those that hold that information

(e.) a description of the efforts used to maintain the secrecy of the information: It will be held as company confidential and used as such. We may consider patenting the Intellectual Property if developed.

PATENTS/RIGHTS TO TECHNICAL DATA

Any patents or rights that the applicant wishes to reserve must be identified in the application. If this does not apply to your proposal, please note that below.

MMP in conjunction with USDA already owns patents 8,481,677 and 9,644,228 covering the production of protein concentrate from starch grains and uses thereof. Development of integration techniques may produce additional patentable processes.

Appendix A

Fluid-Quip FEL1 Proposal

6105 Rockwell Drive NE, Suite C
Cedar Rapids, IA 52402
(319) 320-7709
www.FQPTech.com

Date: May 21st, 2018

To: Midwest AgEnergy Group (Dakota Spirit AgEnergy Facility)

Re: Barley Protein FEL1 Proposal

Adam,

FQPT is pleased to submit the enclosed proposal to provide a FEL1 engineering analysis tied to the barley protein project for the Dakota Spirit AgEnergy ethanol facility in Spiritwood, ND. Upon reviewing the Proposal, we would like to discuss this with you and your leadership team to fully answer any questions you may have about the work product and deliverables.

As a background to this Proposal, FQPT has undertaken similar projects in the development of an FEL1 engineering package for the integration of a new technology into an existing ethanol facility. FQPT's team of experienced engineers have a deep understanding of the base ethanol production process and the technical knowhow of how best to perform these initial FEL1 engineering studies related to the incorporation of new technologies into an ethanol production process.

FQPT's has extensive experience in all major base ethanol and related bolt-on technologies, thus we bring a diverse and integrated evaluation effort to every project we perform. With the deep operational knowledge and expertise within the dry grind ethanol industry, FQPT is ideally situated to efficiently and cost effectively integrate the proposed barley protein technology into the facility's base ethanol operation, all while effectively deploying capital with the highest return.

Please do not hesitate to contact me with any questions, in the mean time we look forward to working with you and your team again on this effort.

Sincerely,

Neal Jakel
VP Strategy & Technology
Fluid Quip Process Technologies, LLC
njakel@fqptech.com
(608) 921-3320 mobile

PROJECT SUMMARY

Dakota Spirit AgEnergy (DSA) ethanol plant in Spiritwood, ND is currently investigating the potential of adding a new barley protein technology into their ethanol facility. The barley protein technology consist of a separate barley processing system starting with grain receiving through protein drying and storage. Design capacity is in the range of 15,000 – 25,000 tons per year of barley protein product production.

This FEL1 Proposal will develop the initial high level process engineering and layout details to enable the development of an initial capital cost estimate for the proposed barley protein concentrate technology. There are several key aspects of this Proposal that include the following;

- Mass and Energy Balance (MEB) of the current plant operations with the incorporation of the new barley protein concentrate technology
- High level layout of the proposed technology on the DSA process facility site
- Summary of equipment list tied to new technology
- Development of an initial capex and opex cost estimate for the bolt-on technology

Below is a summary of the work to be performed at the facility as well as the project deliverables as part of this work product.

1. SUMMARY OF WORK

FQPT shall perform the following scope of work associated with the components listed below:

- Perform a mass and energy balance of all major flow streams within the base ethanol production process including the incorporation of the new proposed barley protein technology system.
- Develop a process block flow diagram of the proposed system.
- Generate a proposed barley system layout on the DSA site.
- List of potential impacts to the plant with the addition of barley protein technology.
- List of specific barley protein system required equipment, estimated equipment sizing, and electric usage.

1. Site review and data gathering evaluation effort (estimate of 3 weeks):
   1.1 FQPT team to perform an on-site review and technical information gathering exercise at the Spiritwood, ND ethanol facility (estimate an initial on site data gathering time of up to 5 days).
2. Mass and Energy Balance Work (estimate of 3 weeks):
   2.1 FQPT to complete a mass and energy balance for the main flow streams of the ethanol production process and proposed barley protein system in Excel format at the current production rate.
3. Engineering Detailed Work (estimate of 4 weeks):

3.1 FQPT to generate a system/equipment summary list that will identify all major equipment capacity.
3.2 FQPT to deliver a list of identified potential impacts of the proposed barley protein system to the base ethanol plant.
3.3 Provide a general high level equipment summary list tied to the barley protein system.
3.4 High level layout of the barley protein system on the plant site drawing.

2. DELIVERABLES

The following is a list of deliverables associated with the project proposal:

1. Mass and energy balance in block flow diagram for each major ethanol process components, with the integration of the barley protein process. Process will start with and include the ethanol slurry mixer and going through and including 200 proof dehydration out to the 200 proof storage tank, with the incorporation of the proposed barley protein system mass and energy balance starting with the milling of the barley through protein drying, will be integrated into the overall base plant mass and energy balance for the facility. Flow diagram will not include details of the base ethanol plant steam system, condensate, plant air, RO water, seal pot water, dryers, ethanol or DDGS loadout, grain receiving, corn grinding or other basic ethanol plant utility systems.
2. Generate an equipment list for the barley protein system with preliminary equipment sizing and specifications for budgetary pricing.
3. Preliminary barley protein building layout, size and description.
4. Architectural drawings of the proposed barley protein building.
5. Overlay the basic barley protein facility system on the existing site plan.
6. General utility requirements (cooling water, steam, enzymes, chemicals, connected Hp) for the barley protein system only.
7. Summary report of potential technology impacts of the barley protein system to the base ethanol plant.
8. Capital and operating cost estimate for the barley protein technology addition to the base ethanol plant.
9. Presentation of findings to DSA management team.

3. ASSUMPTIONS AND EXCLUSIONS

The following assumptions have been made in the preparation of this Proposal:

1. No process warranties are implied as part of this proposal.
2. Cost estimates based on typical engineering and best practice assumptions.
3. Project does not cover mass and energy balance/design criteria around the base ethanol plant utility systems, including any co-gen system, RO water, pump seal water,

ethanol or DDGS storage, ethanol or DDGE loadout systems, corn receiving, boiler/steam generation, steam condensate, steam tube dryers, chiller system, DCS system and electrical system capacity. Mass and energy balance efforts starts at the feed to and including the slurry mixer and goes forward through and including the 200 final product production out to the 200 proof day tank and the addition of the barley protein system.

4. Access to needed DCS screen shots.
5. Access to live process data (i.e. pressures, flow rates, temperatures, pump ratings, etc...) that are critical for the mass balance efforts.
6. Access to the facility's P&ID's and plant layout in CAD format.
7. All data will be considered Confidential in nature and shall be governed by the FQPT DSA NDA agreement (to be executed).
8. Proposal details are governed by the attached (separate) FQPT Proposal Terms and Conditions.

The following exclusions are not included as part of this overall process constraint engineering work.

1. All taxes and permits are excluded from this Proposal
2. No electrical power study will be performed with this Proposal
3. No commodity or detailed engineering work, such as civil, electrical, structural, automation, instrumentation work is part of this Proposal
4. No air permit review or preparation work is part of the Proposal
5. No arc flash study of the electrical review is part of this Proposal

4. COSTS

FQPT has estimated that the aforementioned scope of work can be completed on a fixed cost basis not to exceed for the Proposal as follows:

Description	**Total**
Data gathering, mass and energy balance summary, barley protein summary deliverables	$107,500
Total Cost	**107,500**

Proposal includes 1 site visit to the Spiritwood, ND ethanol plant as part of this Proposal for the initial data gathering exercise as well as 1 site visit to the protein pilot facility in Montana. If additional site visits are requested, the additional cost is $2,200 per day plus travel cost per Process Engineer.

Costs in excess of the budgeted total, will not be incurred without the prior written approval by the DSA management team.

5. SCHEDULE

FQPT has estimated that the scope of work included with this Proposal should take about 10 weeks to fully complete all aspects of the Proposal from the initial site visit. As sections are completed, partial report delivery may occur.

Engineering Invoicing Schedule:

- 25% of budgeted Proposal cost due upon acceptance of the Proposal and/or issuance of a purchase order to proceed
- 25% of budgeted Proposal cost due upon initial system layout review
- 25% of budgeted Proposal cost due upon initial draft mass and energy balance
- 25% of budgeted Proposal due upon delivery of the final documents per this Proposal

All invoices will be sent via email to DSA (attention Adam Dunlop) with payment due within 15 days of invoice issuance. A late fee of 2% per month will be incurred until all payments are caught up and no outstanding amounts are due.

6. ACCEPTANCE

Offered by: (FQPT)		Agreed to and Accepted by: (Dakota Spirit AgEnergy)	
	May 18th, 2018		
(Signature)	(Date)	(Signature)	(Date)
Neal Jakel, VP Strategy & Technology			
(Printed Name/Title)		(Printed Name/Title)	

Montana Microbial Products
P. O. Box 81, Melrose, MT 59743
Phone: (406) 599-7090, Fax: (866) 415-7904, E-mail: bkearns.mmp@gmail.com

July 15, 2018

Karlene Fine, Executive Director
North Dakota Industrial Commission
State Capitol – 14th Floor
600 East Boulevard Ave Dept 405
Bismarck, ND 58505-0840

RE: Barley Protein Concentrate/Midwest AgEnergy Group

Montana Microbial Products (MMP) is pleased to be working with Midwest AgEnergy Group to commercialize barley protein concentrate. In support of that effort, MMP will contribute labor, market information, and technical knowledge. MMP will operate its pilot plant as necessary to provide data for the engineering feasibility portion of the project. Contributions from the pilot plant operation include barley, enzymes, utilities, labor and analytical support.

The aquaculture industry and agriculture in general is short on quality, high concentration, digestible protein. We look forward to seeing this commercialization effort provide part of the solution to this on-going problem.

Sincerely,

Bob Kearns
Managing Member
Montana Microbial Products
79 E Bovine Way
Melrose, MT 597