



TECHNOLOGY SELECTION PROCESS FOR ETHANOL FACILITIES

Meeting facilities' goals and operational objectives
through FQT's technology evaluation process



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ABSTRACT

As the ethanol industry continues to mature, the need for diversification is ever more important, especially given the limited market and market volatility of ethanol. Ethanol is still approximately 75% of the typical plant's revenue and is held captive to external market influences. The same is true for DDGS, given the commodity nature of this product. New products, new markets, hence new opportunities for the ethanol industry are here today and are growing.

As the leading process engineering and biofuels technology firm, FQT has developed a suite of commercially proven technologies that help ethanol plants truly become bio refineries via product diversification. Likewise, many ethanol facilities and technology providers in the industry have used FQT to verify and prove out technologies as an independent third-party review company. As a result, FQT has

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developed a technology validation strategy, which plants can use to evaluate technologies and companies competing for limited capital dollars. FQT has compiled a list of questions and information that plants should have answers to, before investing in any company, process or products. The goal is to help management teams and board members discern between proven technologies and unproven technologies, and to better select projects to more closely align with the facilities' goals and operational objectives. This evaluation process helps separate proven, viable technologies from unproven and over-hyped technologies. In today's race for new processes and products, there are many promises being made with no backup or supporting data. This evaluation process will help separate the leaders from the laggards.

We have grouped these evaluation points into sections, which can easily be used during the selection process to evaluate projects/ technologies based on industry/business standards.

INTRODUCTION

While ethanol facilities need to diversify to maintain revenue streams, it's important to get all the facts. With proper evaluation, ethanol facilities can determine a realistic, long-term view of the value and return on investment before adding new technology and equipment to their operations. By using the following evaluations from FQT, plants will be better prepared to start the process and make the best informed decision.

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SELECTION PROCESS

1 Ready for commercial operations

- If pilot only, what size/scale and how long in continuous operations – not starting and stopping, but true 24/7 operations?
- Current commercial scale production of fully integrated system into a full-scale ethanol facility: How big (quantity, grind rate) and how many total systems in operations?
- How long, hours, months, and years has the commercial scale system been in continuous operation?
- Actual impact (proven by data) to the base ethanol plant: List both positive and negative proven attributes as well as potential non-proven attributes.
- What has been implemented to mitigate negative impacts?
- Actual cost to operate system (electrical, enzymes, natural gas, steam, chemicals, maintenance, added head count, overhead (SG&A), sales support, technology fees, marketing fees, etc.)
- What are the actual/proven product yields from the commercial scale system – not theoretical or potential?
- Guarantees of the actual product yield. Is there a penalty (monetary) if the system does not meet guarantees? Note: Every technology, no matter what, should have a process guarantee, with a monetary value tied to it. This is must for any facility.
- Testimonials from actual plant leadership team running/operating commercial scale system. Ask for names of people to contact directly.

2

Equipment design and reliability

- How many new, not used before in grain processing, unit operations are utilized in the system?
- Has the equipment been deployed previously? What is the overall reliability of each unit operation/equipment with regard to up time and reliability?
- What has/have been the system and/or equipment failures and what has been done to eliminate those issues?
- Equipment supply chain robustness – who from, guarantees, depth of technical service team, spare parts availability, cost, etc.
- Maintenance cost and overall ease of maintenance of the system for each specific unit operation.



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There are many technologies within the ethanol industry that did not meet expectations for a number of reasons. Proper and detailed due diligence is the only way to fully reduce your plant's overall risk to new technology.

Dollar amounts are installed cost estimates only.
All trademarks are the property of their respective owners.



3

Marketability of produced products

New feed product

- Amount of commercially produced product manufactured to date – total mass (tons).
- Actual yield of product on a yearly basis—pounds / bushel.
- Consistency of product production volume and product quality/specification – ask for extensive product testing data by independent third-party testing labs.
- Number of external full-scale feeding trials performed on commercially produced product, not pilot scale samples. Show summary results of all feeding trials.
- AAFCO definition – legal review, show documentation to support definition, request legal confirmation of product.
- If there is no AAFCO definition, what is the plan and what has been done to validate it?
- Is the product branded, is it trademarked, and if so, in what countries?
- What rights does the plant have to use the brand?
- Actual sales price of the commercially proven product, FOB the commercial facility – ask for sales contract.
- Who markets the products, what is their experience in new product development/introduction?
- What countries do they have expertise/personnel in?
- Has product been registered in targeted countries for import?



4 Intellectual property rights - FTO

- Freedom To Operate search - proof in the form of legal documentation that states the right of the purchaser (plant) to operate the system with no patent infringement.
 - List of related patents and processes and why this system is different.
 - Guarantee in contract for IP protection and the amount of protection offered.



5

Depth of technology / engineering provider to engineer, service, manage installations, and after sale support

- Technical support of process and design:
 - Number of process engineers with relevant experience
 - Number of overall technical staff
 - Number of total engineers with experience in the technical process, and will there be enough of them to have on-site engineering during a project?
 - Number of project managers, construction managers, process engineers, site engineers
 - Number and experience of maintenance staff to support technology equipment?
- Start-up/commissioning support capacity – number of people and their skills and experience.
- Relevant design experience; civil, electrical, structural engineering experience/ capabilities.



6

Financial analysis of technology

- Financial risk of the technology needs to be well understood and fully vetted. NPV and ROI should all be risk adjusted and not straight line calculated.
 - Proven technology has less risk than a technology with 0-4 plants operating.
 - Additional risk assessments should be given to co-product market development.
 - Actual sales prices for co-products provides less risk than theoretical market values.
- Financial model should be driven by the plant. Utilization of the technology provider's financial model is acceptable, if: 1) It is unlocked and available to be manipulated by the plant to add facility specific data fields, and 2) It was prepared by a third party. The facility should contact the third party to verify the development of the financial model.
- Run a tornado chart of top 8 - 10 financial risk points of the project to determine the net range of impact to the NPV of the project, using a viable and wide range to test limits.
- Run a Monte Carlo simulation of the financials.
- Capital cost estimates to be based on all aspects of the project, including a full understanding of owner's cost, including site ground improvements and other critical cost estimates. Many technology providers exclude these costs. Push to fully understand all costs associated with the project and have them included in the total CapEx estimate of the project.
- Holdbacks/dollar amount tied to system performing at expectations on a continuous basis over time, as well as process guarantee amount. Value to be tied to the risk of the project. If technology project is serial #5 or greater on a similar scale, holdback and process guarantees can be lowered to about 5% or less of contract range. If commercial system numbers 1 to 3, holdback and process guarantees should be 25% or more of project, given the risk of technology not performing. Don't be the test site without a large part of the risk (CapEx, financial) guaranteed and bonded by the technology provider.

CONCLUSION

Ethanol facilities can utilize the list of questions to help evaluate options and strategic planning for the facility. Any technology provider should be able to answer these questions in a straightforward manner, with verifiable data to back up claims about their technology, products produced, and a facility's ability to operate the technology without fear of a patent infringement.

Ideally, all data provided by the technology provider should be third-party verified (through existing plant teams, outside partners, financial groups). These fields of information can easily be arranged into a risk-weighted matrix spreadsheet to track answers and data from multiple vendors and technology providers.

WHY FQT?


Fluid Quip Technologies was founded on extensive experience and knowhow within the corn wet milling and ethanol production industries. FQT's engineering and technical leadership team has been developing new technologies and process solutions applicable to the biofuels and biochemical industries for more than 25 years. FQT has industrialized multiple patented technologies geared towards enhancing the base corn-to-ethanol dry grind process, creating new and novel alternative co-products and supplying the growing need for carbohydrate building blocks in the biochemical market.

LET'S GET STARTED

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“We believe in getting the highest value for the corn we grind, the MSC system is a proven way to not only significantly increase our revenue, but also diversify our revenue stream so it is not so heavily weighted on ethanol.”

STEVE ROE
GENERAL MANAGER
LITTLE SIOUX CORN PROCESSORS