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Radio Frequency Grain/Biomass Drying

- Applying Radio Frequency (RF) energy to the grain or biomass drying process can reduce the total energy cost to the producer/processer
- RF drying of grain/biomass is faster, allowing producers more time and flexibility in harvesting and moving produce to markets to maximize profits
- Flexibility associated with applying RF drying can allow utilities and producers to work together to design mutually-beneficial rate structures to take advantage of off-peak and shoulder-month lower demand scenarios

Background, Objectives, and New Learnings

Currently grain drying after harvest is dominated by natural gas- fired forced air systems in grain bins and elevators that are ubiquitous across the row crop growing regions of the U.S. and Canada, as well as other international grain production regions. Radio Frequency (RF) drying technology developers have had little success in convincing traditional and skeptical crop producers to deploy full-scale RF-based systems. Power delivery and load requirements are unknown and utilities recognize the distribution, load shape, and seasonality challenges of serving this agricultural sector. Potential system performance characteristics in terms of net energy usage, operating cost, grain quality impacts, productivity and capital return are unknown for the crop producers. It is also unknown whether specific grains (corn, soybeans, hops, barley, etc.) and biomass feedstocks (corn stalks, switch grass, algae) will respond differently to RF energy. In addition, the extent to which renewable electricity production and storage could be effectively paired with grain drying applications also is unknown.

Benefits

Employing RF to the problem of achieving massive amounts of grain drying during a concentrated autumn harvest season, and pre-processing other biomass material as feedstocks for other chemical, waste management or electrical energy production processes on a more continuous basis can significantly reduce the use of fossil fuels currently deployed for this purpose. With the continued de-carbonization of generation, this could have a significant benefit for the reduction of associated greenhouse gas emissions.

Furthermore, because of the anticipated load shapes associated with RF drying, there may be an opportunity to strategically match the demand to available or planned utility-scale renewable generation capacity. Additional air quality benefits may exist in terms of reduction of other air pollutants from natural gas combustion. Furthermore, the cost reduction and market efficiencies of RF drying may help support the financial health of grain farming industries, providing downward pressure on staple grain-derived end-products to consumers.

Funders of this project are expected to benefit from the development of data and analysis that can be used to support business case analysis for prospective end-customers to convert to RF drying techniques. Improved load shape data and analysis are also anticipated to aid in system impact and cost effectiveness analyses for potential inclusion of measures in electrification programs, and to feed into system planning, IRP, and rate design processes.

Project Approach and Summary

It is anticipated that this project will support the deployment of up to three RF drying installations across a diversity of agricultural commodities or other process feedstocks across the 2019–2020 planning period. The project intends to collect baseline data on existing process performance, including all elements of crop/biomass drying such as operating cost, energy inputs, and emissions, in order to develop a comprehensive long-run financial and carbon model that explores alternative grain drying options. Data logging equipment may be installed on targeted bin systems during the current drying season for grains, or within process

flows for other non-agricultural operations, to gather clean energy and cost baseline data, which can then be used for subsequent validation of energy and cost impacts of the RF systems. This supplemental project also aims to allow EPRI to support funding utilities as they promote electrification of grain drying processes (or other high-moisture bulk material) with validated energy and financial modeling techniques and business cases. Results can be fed into future case studies and marketing materials in which grain and bulk material drying load characteristics, power delivery challenges, and renewable opportunities can be explored.

Deliverables

2019

- Feasibility study and business case report
  A comprehensive business case supporting RF process solution for a specific grain/bulk drying operation intended for the supporting utility and its end-customer.
- Financial and energy modeling results and guidance for RF grain drying applications
  Summary of industry knowledge and analytic capabilities developed from business case to support future business case development on behalf of member utilities as we deliver electrification process assessments in agricultural operations.

2020

- RF grain drying load shapes
  Data gathered that can support further fine-tuning of load shapes for RF curing operations.
- EKB Update
  Electrification Knowledge Base update based on learnings from the project.
- Marketing Support
  Assist with collateral and vendor engagement, feed case studies and Tech Cut Sheets as requested.

Price of Project

This research supplemental is priced as follows:

- Each host location: $65,000
- Each participant: $25,000

The intention is for hosts to receive detailed site-specific financial information and access to site data, as well as all participant deliverables. Participants would receive higher-level feasibility reports with generalized cost and load shape information, market guidance for technology applications and marketing materials.

Commitment of one (1) host site is required to start the project. Each new site requires a host at the host price. Opportunities exist to receive state and federal grants through state agricultural agencies and USDA. To the extent that this occurs and as additional funders and/or hosts are engaged, the scope of the project may be expanded and lengthened to include additional sites, suppliers, commodities, and feedstocks supporting a variety of industries. The funding is anticipated to achieve the proposed deliverables over the 2019 to 2020 budget years.

Project Status and Schedule

This project intends to build on 2018 research including initial data for one site, technology, and vendor research, grant preparation and collaborative agreement development, and project scoping.

This project intends to identify additional customer sites and collect baseline data, as well as engage RF vendor(s) to develop proposals and implementation timelines to work with EPRI, utilities, and end-customers to develop energy and business case analytics. It is anticipated that year-one will involve site selection and equipment installations as well as launching the post-installation data gathering.

The year-two activities include analysis of the system performance, validation of implementation and operating costs, development of load shapes, updating the EKB and providing marketing collateral and support to funders as needed. The intention is also to identify, launch, and extend the program for further iterations as additional funding permits.

Who Should Join

Members with significant staple grain crop harvesting and drying or other biomass drying operations in their service territories should consider joining this project.

Contact Information

For more information, contact the EPRI Customer Assistance Center at 800.313.3774 (askepri@epri.com).

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