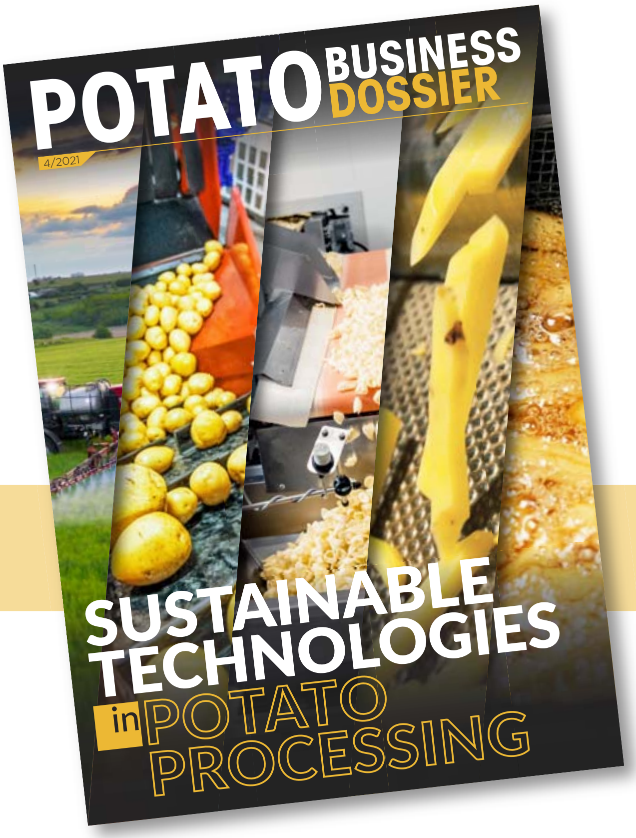
POTATO BUSINESS DOSSIER

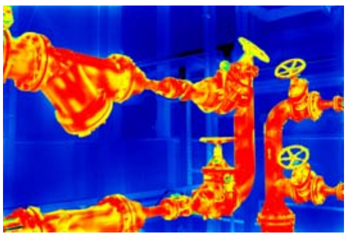
4/2021

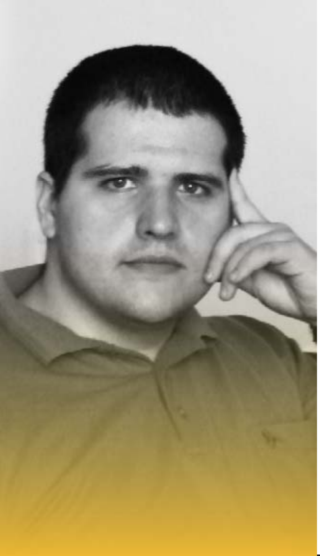
SUSTAINABLE TECHNOLOGIES in POTATO PROCESSING



ISSUE 4 - 2021

content





Using Less Energy to Provide the Same Level of Output and Services

COMMENT

IONEL VĂDUVA
on-line editor

Roughly, all activities in the food system rely upon some form of energy provided by fossil fuels. The need to use a short supply of natural resources efficiently, reduce greenhouse gas emissions, minimize energy costs and foster the competitiveness of the agro-food sector highlights the importance of the energy efficiency issue: using less energy to provide the same level of output and services.

Energy figures show that among others, manufacturing French fries and potato chips are some of the most energy-intensive procedures. The thermal processes involved in their manufacturing consume large proportions of the total processing energy.

Regarding food transportation, more than 98% of all foods within the big European potato processing countries are carried by road, and the distances traveled have increased in recent years. Tertiary distribution using rigid vehicles was the most energy-intensive transportation method, while primary distribution at ambient temperature was the least. Refrigerated transportation, which is more intensive than stationary refrigerated systems, has also increased during the past years.

In response to environmental policies and rising social concerns, the food-manufacturing sector has already undertaken important transformations to meet long-term reduction goals on energy and water demand (e.g. fuel switching, investment in new energy-efficient equipment, and low carbon technologies).

Initiatives like the "Five-Fold Environmental Ambition" promoted by the UK Food and Drink Federation have led to a 44% reduction in CO_2 emissions from energy used in manufacturing. However, in a global scenario of a growing population and food demand - the food industry will have to meet the demands of 9bn people by 2050 - additional efforts will be required to meet the 2050 sustainability goals (80–95% energy reduction from the 1990 baseline).

Energy demand quantification during food manufacturing and distribution is key to identifying intensive activities, providing useful information for policy and industry decision-makers. By targeting those processes that represent a hot spot (such as those involving phase changes) significant reductions in the sector energy consumption can be achieved.

Global environmental assessment tools (such as LCA, carbon, and water footprint) that consider the whole food chain will be increasingly important. Overall, it is necessary to standardize reported consumption data across the sector, and policy efforts must be devoted to this task urgently. Only then will it be possible to develop efficient strategies to optimize the whole food system, allocate resources more effectively, and reduce both waste and fossil fuel dependency. ■

> In response to environmental policies and rising social concerns, the food-manufacturing sector has already undertaken important transformations to meet long-term reduction goals on energy and water demand.

Wastewater Treatment in Potato Processing Operations

In the last twenty or so years, the potato processing industry has experienced rapid growth globally, accompanied by an astounding increase in the amount of wastewater produced. Extensive volumes of wastewater and organic wastes are generated in the spud processing as a result of the water used in washing, peeling, and additional processing operations.

By Ionel Văduva

A reliable supply of sufficient processing water is a main concern for potato processors worldwide. In regions where there is a lot of pressure on the available water resources, processors are forced to invest in water use optimizations and water reclamation to secure production and/or an eventual increase in production.

At the moment, there is an increasing demand for quality improvement of water resources as well as the demand for better-finished products. These demands have driven the potato industry to develop methods for providing effective removal of flocculent and dissolved solids from the potato processing wastewater, to meet national water quality limits. In addition, extensive research has been dedicated to waste reduction and utilization of recovered wastes as byproducts.

"The waters resulted at potatoes washing for chips, snacks or fries production are valuable wastes, which contain organic compounds as proteins (around 0.7%) and starch (around 1.66%). Because these wastewaters are obtained from already washed potatoes, they have a low microbial charge, including a small number of coliforms, and no pathogens as Salmonella, Bacillus cereus or staphylococci," Monica Mironescu wrote in her "Investigations on wastewaters at potato processing and starch recovery and characterization" research paper.

Water consumption for fluming (i.e. an economic way of transferring large volumes of low-medium pressure moving water) and washing varies considerably from plant to plant. Flow rates vary from 4,921 to 7,949 liters per ton of potatoes.

"Depending upon the amount of dirt on the incoming potatoes, wastewater may contain 45–181 kg of solids per ton of potatoes. For the most part, organic degradable substances are in dissolved or finely dispersed form, and amount to 0,9–2,7 kg of BOD5 (biological oxygen demand) per ton of potatoes," Yung-Tse Hung and Howard H. Lo from Cleveland State University, USA, and Adel Awad and Hana Salman from Tishreen University, Syria also wrote in their "Potato Wastewater Treatment" paper.

A KEY CHALLENGE FOR FOOD PRODUCERS

Before they can be turned into foodstuffs, potatoes must be peeled, sliced, destoned, and washed, processes that require a significant amount of water. In recent years, hot washing systems and pulsed electric field (PEF) technology have largely replaced the traditional blanching process as the method of choice for removing excess starch before frying. As before stated, these techniques have helped make materials handling more efficient, but managing water usage while maintaining the quality of the final product remains a key challenge for food producers. Where water resources are becoming scarce, emphasis is given to a reduction of the overall amounts of processing water.

"A high recirculation rate will be a common practice in the future. It seems that we could manage in most cases with 10-25% of the present usage of water for processing without loss of product quality," H. Peters from the Twente University of Technology mentioned in his "Measures taken against water pollution in starch and potato processing industries".

The processing of potatoes into foodstuffs delivers wastewater from the peeling stage as the main source of pollution. Lye-peeling especially produces heavily polluted wastewater. In most cases, lowering the total wastage of raw material during processing is possible, e.g. by using improved peeling methods.

As the wastes of the potato processing industry have no toxic components, they can be treated by biological processes common in normal sanitary engineering. A primary treatment could be necessary in cases where many suspended solids are discharged. For the larger processing factories and mills, utilization of potato wastes for the recovery of by-products like potato protein and the production of yeasts, bacterial cells, fungal mycelia, and other rich feed concentrates could be economical and should get more attention as the world's protein shortage becomes more acute.

HOW TO GENERATE WASTE EQUAL TO A CITY OF 200,000

Since spud processing wastewater contains high concentrations of biodegradable components such as starch and proteins, on top of high concentrations of chemical oxygen demand (COD), total suspended solids (TSS), and total Kjeldahl nitrogen (TKN), the potato processing industry presents potentially serious water pollution problems.

"An average-sized potato processing plant producing French fries and dehydrated potatoes can create a waste load equivalent to that of a city of 200,000 people. About 230m liters of water are required to process 13,600 tons of potatoes. This equals about 17 liters of waste for every kilogram of potatoes produced. Raw potato processing wastewaters can contain up to 10,000 mg/liter COD. Total suspended solids and volatile suspended solids can also reach 9,700 and 9,500 mg/liter, respectively," the scientists wrote in their "Potato Wastewater Treatment" paper.

Experts say that wastewater composition from potato processing plant depends on the processing method, to a large extent. Generally, washing the raw potatoes, peeling, which includes washing to remove softened tissue, trimming to remove defective portions, shaping, washing, and separation, heat treatment (optional), final processing or preservation, and packaging are the usual steps applied in potato processing.

The potatoes formulation used in their processing operations determines the components of the resultant waste stream. Foreign components that may accompany the potato include dirt, caustic, fat, cleaning and preserving chemicals.

Water consumption for fluming (i.e. an economic way of transferring large volumes of low-medium pressure moving water) and washing varies considerably from plant to plant. Flow rates vary from 4,921 to 7,949 liters per ton of potatoes.

An average-sized potato processing plant producing French fries and dehydrated potatoes can create a waste load equivalent to that of a city of **200k** people.

Processing involving several heat treatment steps such as blanching, cooking, caustic, and steam peeling, produces an effluent containing wooly starch and coagulated proteins. In contrast, potato chip processing and starch processing produce effluents that have unheated components. As for the starch plant effluent, the resulting protein water and pulp form about 95% of the plants.

An integrated waste treatment system usually consists of three phases: primary treatment, secondary treatment, and advanced treatment. Primary treatment involves the removal of suspended and settleable solids by screening, flotation, and sedimentation. Secondary treatment involves the biological decomposition of the organic matter, largely dissolved, that remains in the flow stream after treatment by primary processes. Biological treatment can be accomplished by mechanical processes or by natural processes.

POTABLE DRINKING WATER FROM WASTEWATERS

Food and beverage processing involves a significant amount of wastewater, most commonly treated in a typical anaerobic-aerobic wastewater-treatment plant. The effluent produced from this conventional type of treatment is an ideal source for further refining into perfectly hygienic, potable drinking water, and clean energy, something that can help plants save on water intake and energy costs.

With a global capacity of 1.3m tons of processed potatoes annually and 1,500 employees, Farm Frites is one of the largest operations of its kind in the world. Over the years, though, this successful company has faced groundwater scarcity, limited groundwater-permit availability, increased costs of sourcing tap water, and stringent wastewater-discharge regulations.

To tackle these challenges, Farm Frites partnered with its drinking-water supplier, De Watergroep (Brussels). Together, the organizations developed a sustainable, tailor-made solution that met the potato processors' water demand and complied with the governing water agency's strict regulatory framework.

De Watergroep, in turn, partnered with Waterleau for the design and construction of the wastewater-effluent-treatment solution. Waterleau's Boomerang water-reuse technology consists of successive ultrafiltration (UF) and reverse osmosis (RO) treatment process that converts wastewater into potable water that can then be reused in the plant.

Ultrafiltration membranes provide a physical barrier to remove bacteria, suspended solids, and harmful pathogens. This technology has been proven in many water reuse installations worldwide.

The resulting water quality is characterized by low turbidity and SDI (silt density index) value. It is fed directly to the downstream RO installation, extending RO lifetime and reducing its associated operating costs. During ultrafiltration, backwashing is typically performed at fixed intervals, during which the flow direction in the membranes is reversed for a short period. This removes most of the suspended-solids layer that has built up on the feed side of the UF membrane. To improve backwash efficiency, it is recommended to follow with a forward flush to remove the suspended solids.

"Another nice example is the improved Reversed Osmosis technology. With the CCRO, or so-called RO 2.0, recoveries on this treatment step are increased by 20%. Where a conventional RO system can work with a recovery of process water efficiency of 65 to 75 %, the CCRO system can work at recoveries above 90%. Quite some extra yield on the cubes of process water," Waterleau experts concluded. ■

Are you up for a reduction in your:

- Cleaning time
- Oil consumption
- Power usage
- Total cost of ownership

Head to kiremko.com

fair future KIREMKO

kiremko.com +31 348 47 94 00 | idahosteel.com +1 208 522 12 75

Energy Efficiency Drives Increased Profitability

Potato product fabrication and preservation are some of the largest contributors to food manufacturing emissions worldwide. Frying is a highly energy-intensive process and in industrial potato chip production lines, for example, frying is responsible for more than 90% of the total energy expenditure.

By Ionel Văduva

When it comes to the frying process, most of the energy used is associated with the evaporation of water present in the potato and on the surface of potato slices. The rest is from the evaporation of frying oil and heat losses from the fryer wall surface by convection and radiation, or through the air of the ventilation system.
"The frying oil is heated by an industrial gas furnace and the efficiency of this process was calculated to be 84%. The efficiency of the overall frying process which was found to be around 70% can be improved by employing exhaust heat recovery and optimizing other operating and control parameters such as exhaust gas recirculation," according to Hongwei Wu, Savvas Tassou, Hussam Jouhara, and Tassos Karayiannis' "Modelling of energy flows in potato crisp frying processes" paper.
In the potato chips production process, frying takes up more than 80% of the total processing energy requirement so the greatest potential for energy savings is offered by design and control optimization to minimize heat input to the potato slices and reduce thermal losses. Frying is a complex processing operation and optimization implies short frying times, high product quality, and reasonable costs.
On the other hand, drying potatoes consumes large amounts of energy due to the high initial water content of the raw material. Chips are dried until a 2% water content is achieved, and since potato flakes have a lower final water content than French fries, their production is much more energy-intensive.
The drum drying process consumes an estimated 6,000 Btu of steam per pound of dehydrated mashed potatoes. The drying process is one of the most energy-intensive processes employed in the entire US food processing industry, with typical energy intensity values ranging from around 1,500 Btu per pound of water in the product to over 28,000 Btu per pound of water in the product.
"Single and double-drum dryers are typically used to dehydrate potato-based products. Increasing the drying air temperature can increase the drying rate, however, the product quality might be damaged. The use of ultrasound to improve water mobility has been proposed, with experimental results showing that the drying time can be shortened by 40% compared to experiments where ultrasound was not used. The energy consumed to produce vegetable oil was not included in any of the literature discussing these products. Energy studies on multi-ingredient products were rarely found," Alia Ladha-Sabura, Serafim Bakalisa,b, Peter J. Fryera, and Estefania Lopez-Quiroga wrote in their "Mapping energy consumption in food manufacturing" paper.
The freezing process is the most energy-intensive operation in the manufacture of frozen French fried potatoes. After freezing, the next largest consumer of energy in frozen French fried potato manufacture is typically the frying process, which consumes a significant amount of direct fuel (primarily natural gas) to heat the frying oil. Peeling, precooking, and cooking are estimated to be very energy-intensive processes, also.
The US fruit and vegetable processing industry alone (canning, freezing, and drying or dehydrating of fruits and vegetables) consumes over USD800m worth of purchased fuels and electricity per year. In the UK, chips manufacturing is estimated to be around 220,000 tons per year and is responsible for around 0.18 $MtCO_2e$.

A FOCUSED AND STRATEGIC ENERGY MANAGEMENT PROGRAM IN POTATO PROCESSING

Energy efficiency is of particular importance to the spud processing industry, due to the rapid rise in energy costs in the last few years and the volatility of energy prices. Energy costs represent a significant proportion of the overall production costs in various process sectors, and energy efficiency can offer one of the best approaches to increase profitability even in what are perceived as mature and energy-efficient processes. Achieving energy efficiency in several ways, including improving the efficiency of equipment and unit operations, heat recovery, and process integration is of utmost importance. Over the last three decades, considerable research and development effort has been devoted to these fields. Process integration and optimization involve some techniques and methodologies that can be applied systematically to facilitate the selection or modification of processing steps in large processing plants to minimize energy consumption and resource use. At the moment, there are a variety of opportunities available at individual plants in the potato processing industry to reduce energy consumption cost-effectively.

In the potato chips production process, frying takes up more than 80% of the total processing energy.

ENERGY EFFICIENCY MEASURES AND PRACTICES

Flue gas monitors maintain optimum flame temperature and monitor carbon monoxide (CO), oxygen, and smoke. The oxygen content of the exhaust gas is a combination of excess air (which is deliberately introduced to improve safety or reduce emissions) and air infiltration. By combining an oxygen monitor with an intake airflow monitor, it is possible to detect even small leaks. A small 1% air infiltration will result in 20% higher oxygen readings. A higher CO or smoke content in the exhaust gas is a sign that there is insufficient air to complete fuel burning. Using a combination of CO and oxygen readings, it is possible to optimize the fuel/air mixture

279k
USD/year in cost savings were generated due to flue gas oxygen analyzers, flue gas recirculation ducts, and boiler controls being installed on two boilers at the J.R. Simplot Company.

for high flame temperature (and thus the best energy efficiency) and lower air pollutant emissions.
At the J.R. Simplot Company potato processing facility in Caldwell, Idaho, the installation of new burners equipped with process controls and a flue gas trim system led to significant annual savings in natural gas consumption. The Caldwell facility produces approximately 122,469 tons of frozen French fries each year and uses steam in its potato peeling, blanching, and frying operations. A few years ago, new burners, flue gas oxygen analyzers, flue gas recirculation ducts, and boiler controls were installed on two boilers during plant outages. Natural gas consumption was reduced by 7.5%, resulting in cost savings of USD279,000 per year and a payback period of around 14 months.
Heat recovery from flue gas is often the best opportunity for heat recovery in steam systems. The heat from flue gas can be used to preheat boiler feedwater in an economizer. While this measure is fairly common in large boilers, there is often still room for more heat recovery.
McCain Foods, a major producer of frozen French fried potatoes, installed an economizer at its Scarborough, England, facility as part of a plant-level heat recovery project. The new economizer saved the facility 67 therms of natural gas per hour, leading to energy savings of GBP67,000 per year with a simple payback period of 2.5 years.

HEAT RECOVERY FROM FRYER EXHAUST GASES

Heat can be recovered indirectly from a fryer's fat-laden exhaust gases via a heat exchange system and used for pre-heating air and water for use in other facility processes. Conditioning of the exhaust gas is required, however, to remove fats and to reduce fouling of the heat exchange system.
Again, McCain Foods installed a special system for recovering heat from exhaust gases on the potato frying line at its Scarborough, England. Fryer exhaust gases were first saturated with water vapor using turbine washers, then routed to a two-pass shell and tube vapor condensing heat exchanger. The heat exchanger shells were oriented vertically, which allowed condensate, fat, and fatty acids to drain freely into a sump below the heat exchangers. The heat exchanger was used to pre-heat air for the facility's potato chip dryers, to heat water used in potato blanchers, and to provide facility hot water. Exhaust gases exiting the vapor condenser passed through a scrubbing tower and were discharged to the atmosphere. Heat recovery from the fryer exhaust gases saved the company a reported GBP77,060 per year in natural gas costs.
It is also possible to recover additional heat from a fryer's fat-laden exhaust gases using direct combustion. Commercially-available fryer gas combustion systems exist that can recover useful heat in a two-stage process. In the first stage, heat is recovered from exhaust gases exiting the fryer using economizers that pre-heat facility and process water. In the second stage, exhaust gases are combusted in a small natural gas-fired furnace. Exhaust gases exit the furnace at around 700°C to 800°C and are passed through a second heat exchanger, which is used to heat fryer oil.
Adsorption cooling systems can use waste heat instead of electricity to produce chilled water for use in facility air conditioning and process cooling applications. The California Energy Commission financed a demonstration project to evaluate the use of adsorption cooling technology to generate chilled water from fryer exhaust gas heat. A 300-ton adsorption chiller was installed on a potato chip frying line that fried about nine tons of potato chips per hour and produced about 6.8 tons of exhaust water vapor (at 104°C) per hour. Formerly, the exhaust was discharged into the atmosphere. The project was estimated to save about 1.5 million kWh per year in facility air conditioning energy, amounting to about USD123,000 in annual energy cost savings.
Ideally, residual steam from steam-based peelers should be harnessed for heat recovery rather than being discharged directly to the atmosphere. Heat can be recovered from the discharge steam using condensing heat exchange systems and used to heat facility or process water.
The Fritesspecialist company in Arcen, the Netherlands, manufactures both fresh and frozen potato products. A few years ago, the company installed a condensing heat exchange system to recover energy from its steam-based potato peeling process for use as a heating medium for pasteurizing potato pre-heating water. Previously, the company released steam directly into the atmosphere, which was perceived as a nuisance in the surrounding neighborhood. The system works by discharging steam from the peeler into a blowdown vessel, in which a spray of recirculated process water condenses the steam into hot water. The hot water collected at the bottom of the vessel is fed through a heat exchanger to pasteurize process water. The company reportedly saved 852,000 cubic meters of natural gas per year with a simple payback period of 3.4 years. ■

Oil Content Management and Oil Longevity in Potato Processing

Throughout the last decade, rapid economic growth, mechanization, and market globalization across the globe have led to significant changes in diets and lifestyles. The need for longer shelf life led to a need for the amendment of natural forms of foods, one example being the frying process.

By Ionel Văduva

Frying is a bulk transfer method in which heat and mass transfer take place to implement desired changes in the product. "Deep frying allows the expanding of food products because of its distinctive quality attributes, including the formation of a dual structure of the fried product, and the development of distinctive tempting color, flavor, aroma and textural attributes," Devashree Kulkarni, Soumyasudha Panda, Sachin K. Sonawane, and Ashish S. Dabade wrote in their "Reduction Of Oil Uptake From Potato French Fries By Plasticizer Shellac And Ultrasound Technology" paper. The uptake of fat by the fried potatoes, on the other hand, largely takes place during the cooling process, after their removal from the oil medium. The oil that has adhered to the surface migrates into the internal core due to changes in potato micro-structure which have taken place during frying.
Over the last years, the desirability of reducing the fat content of deep-fried products has been recognized as a priority by the industry's players. As a consequence, consumer trends are moving toward healthier foods and low-fat products, creating the need to develop technologies to reduce the amount of oil in fried end products.

REDUCING THE AMOUNT OF ABSORBED OIL IN FRIED POTATOES

Several procedures have been proposed to reduce the amount of absorbed oil in fried potatoes. One of those procedures recommended by researchers is adding fructose to a restructured potato product that resulted in a change of the surface properties, with a reduction of absorbed oil after frying. Another solution is potato strips soaking in NaCl solutions, which could reduce oil uptake by about 15% in French fries after frying. Pre-drying of potatoes is also a common way to reduce fat uptake in the final fried product. Vacuum frying may be also an option for fried potatoes with low oil content and the desired texture and flavor characteristics.
Since the surface properties of potatoes are most important for fat uptake, the application of a proper coating is a promising route to reduce oil content. That's when the gellan gum comes into use, coating samples so that the resulting film reduces the oil uptake during frying. Experts talk also about Hydrocolloids like carboxymethyl cellulose that was proven to reduce the fat uptake in deep fat fried paneer, edible coating of sunflower head pectin was proven to reduce the uptake of fats in fried potato chips, guar gum with sorbitol was also studied to reduce the fat absorption in French fries, and many more edible coatings are being tested for this purpose.
Some experts even suggested the use of shellac as means of a barrier to oil uptake. Shellac is a purified form of the natural resin lac, which is the secretion of the insect Kerria Lacca, also called the lac insect. This secretion hardens and a hardened resin i.e. shellac is obtained.

INDUSTRIAL SOLUTIONS FOR OIL LONGEVITY

In par-frying, the oil itself is just one of many factors that determine oil longevity: the quality of the fried product, the equipment, and the process also impact how long oil can be used.
In continuous frying, oil performance is determined by turnover. The higher the turnover, the more the fresh oil is topped and the longer the oil's longevity will be. Oil turnover is determined by the oil volume in the fryer and the amount of oil absorbed by the fried food.
Oil degradation in a fryer is a very complex process. During the frying process, the oil breaks down due to three different reactions: oxidation, polymerization, and hydrolysis.
The dominant reaction is oxidation. The typical oil flavors (positive and negative) are produced by oxidation. Unsaturated fats react with oxygen, resulting in peroxides, which react further into aldehydes, alcohols, ketones, and acids. The presence of water facilitates hydrolyzation, producing free fatty acids. Polymerization results in the formation of oil gums.
Crumbs should not get in contact with the oil heating system. Particles that stick to the heating elements will burn and carbonize, leading to heat transfer inefficiencies, bitter flavor notes, and eventually to unexpected shutdowns.
The size of the fryer filter should be aligned with the size of the particles that need to be removed, as well as with the oil volume. In addition to filtration, replenishment of oil is required to keep a proper oil level and will rejuvenate the oil.
With continuous frying, oil replacement will mostly be applicable when switching to another oil. Oil discard is only rarely needed if for some reason the oil quality is below standard. In kettle frying (batch process for snack products), oils will need to be changed when predefined discard levels are reached.

40% LESS OIL VOLUME

Indirect-heated fryers are used when reduced oil volumes, minimal thermal degradation, and full oil filtration are required. These systems are more expensive than a direct-heated system for the initial outlay of costs, but in the long term, the operator will see cost savings achieved through oil reduction. Indirect-heated fryers heat oil by circulating it through an external heat exchanger. The cooking oil is also circulated through the frying pan and a filtration system. This type of frying system can match the product heat load requirements to the square feet of frying area required by the product.

The defatting system from Rosenqvists has been proven to add value to many fried snack products by reducing the fat content by as much as 35% over typical levels. That is about a 10% reduction in gross oil content which translates into healthier products with great customer appeal.

The indirect system minimizes the oil volume required for cooking but will guarantee the highest product quality. In the frying vessel, only enough oil to cover the product is needed. This usually results in up to 40% less oil volume in the entire system than that in direct-heated fryers of a similar size. Because of the lower oil volume, indirect-heated fryers deliver excellent oil turnover rates. With indirect-heated fryers, oil is continuously circulated through the fryer and its components. Product particles are constantly removed from the oil, preventing fines and carbon build-up anywhere in the fryer system.
The indirect-heated fryer system uses an external heat exchanger.
"The most common ones include the Coil-Type Heat Exchanger (CTHX) or some type of shell and tube heat exchanger, i.e. thermal fluid or steam. These systems deliver gentle oil heating because the oil flow rate is engineered to maximize heat transfer without thermally degrading or scorching the oil. This fryer can be configured with either inside or outside return conveyors along with a tempura in-feed or free fry area. Oil is introduced to the fryer through single or multiple inlets located at the bottom of the pan. Oil flow can be adjusted at inlet points to match product flow patterns and to minimize temperature drop (ΔT) along the fryer's length. In addition, zone control can be provided for multiple cooking profiles, which can affect the product's characteristics," Heat and Control experts said.

40%

less oil volume in the entire indirect-heated fryers than that in direct-heated fryers of a similar size.

"Cleaning indirect-heated fryers is very simple," they added. These fryers have a built-in, clean-in-place system and the cleaning solution takes the same path as the cooking oil, ensuring that all areas of the fryer are cleaned using a minimal amount of chemicals in a minimal amount of time.
Regeneration of frying fats or oils employing filtration is recommended to eliminate highly oxidized, polymerized fat components and other impurities. Heat and Control offer various, effective options to continuously filter oil and prevent fines build-up in the fryer. Clever solutions like the Drum Pre-Filter or KleenSweep® Centrifugal Separation System by Heat and Control also use these techniques to reduce clean-up time.

10% REDUCTION IN GROSS OIL CONTENT

The defatting system from Rosenqvists has been proven to add value to many fried snack products by reducing the fat content by as much as 35% over typical levels. That is about a 10% reduction in gross oil content which translates into healthier products with great customer appeal. The Rosenqvists Defatting System is ideal for potato chips, tortilla chips, extruded, and pellet-based snack products. Thanks to the high-temperature steam process and advanced filtering, excess fat may be reused with no damage to quality. The Defatter is designed for simple operation with automated control of steam temperature, oil filtration/ recovery, circulatory air pressure, and a variable-speed infeed system. Construction is of stainless steel with inspection panels and doors for easy access throughout. Low maintenance features include a clean-in-place system and easy filtration element service.

A CONTINUOUS MOVE FROM PALM OIL TO SOFT SEEDS OILS

With continuous frying, oil replacement will mostly be applicable when switching to another oil. Already, oil discard is rarely needed, only if for some reason the oil quality is below standard. In kettle frying (batch process for snack products), oils will need to be changed when predefined discard levels are reached. According to Cargill experts, they expect to see a continued move from palm oil to soft seeds oils. This continued change will be driven by the choice of healthier, lower SFA oils (soft seed oils) versus the more price-competitive solution (palm oil).
Other changes these experts expect to see on the horizon include the global phase-out of partially hydrogenated oils by 2023 and the development of alternative frying methods like air or turbo frying, which will drive fried product innovation. These developments may lead to increased use of more stable oils, such as high-oleic sunflower oil. ■

Project Management in Spud Processing Enables Manufacturers to Innovate

In the last few years, considering the market environment for processed potato products, clients' resources have been pushed to the limit, in addition to the difficulty to bring in qualified workers. These setbacks resulted in customers looking for suppliers that could provide turnkey solutions along with efficient project management, to reduce the overall costs and the associated risks.

By Ionel Văduva

A complete spud processing system is more cost-efficient to design from the ground up, manufacture, install, and commission. This enables a potential beneficiary to diminish the projected investment of resources and obtain the desired results quickly.
The benefits of turnkey suppliers and sole components sourcing become obvious once a potato processing operation reaches a specific size and complexity. The ever-increasing competition in the sector, the quest to streamline production, and reduce production costs motivate spud processors to look into the sole sourcing of equipment from a single supplier as a way to ensure a trouble-free production and downtime predictability. Commonly, when several different manufacturing firms are working on the same project, miscommunication, disorganization, and high capability variance all contribute to frustratingly long production lead times.
Turnkey project suppliers offer affluence of knowledge together with their lines, providing flexibility for last-minute changes in production and nearly unlimited customization options. Given that all phases of production can be consolidated under one company, tasks are easier to coordinate, and streamlined communication processes prevent unnecessary misunderstandings. Usually, these systems integrate risk reduction, technical expertise, training, and project management as well as the actual equipment. Although the benefits are obvious, there is still a widespread concern that by opting for a turnkey solution, manufacturers will provide an "off-the-shelf" product that may not necessarily meet specific needs. Even though many solutions were advertised as "plug and play" systems, each turnkey equipment will have undergone a serious amount of customization and fine-tuning before ending up on the factory floor, to ensure the final setup meets the exact requirements of the client.
In particular, as the potato processing industry is moving towards more automation - and it's becoming a lot less about turning a key and a lot more about pressing the right buttons, experts say that ensuring the customers' equipment is set up correctly is more important than ever. With a turnkey solutions provider, a potential customer can be sure that every detail has been taken into account, no matter how small. From analyzing the clients' business needs to designing the technology, to setting up its controls systems and training its staff, a turnkey solutions provider takes full responsibility for the entire project from start to finish.

PROJECT MANAGERS' KEY ROLES IN ANALYZING THE CUSTOMERS' NEEDS

Project management, in particular, plays a key role during the turnkey solution's implementation. By analyzing the customers' needs, their existing assets, and operational requirements, project managers can develop a tailored solution that is on time, on budget, and causes minimal disruption to the rest of the business.
"Pre-testing and pre-building a system offsite, for example, significantly reduces the risk of unexpected problems and delays during installation, ensuring that manufacturers end up with a pre-configured, completely customized solution that only requires them to turn the key. Using the very latest digital software, project managers can create 3D design layouts of equipment, facilitating the pre-building process and keeping downtime to an absolute minimum during installation," Michael Green, group general manager, tna, said.
Furthermore, acting as business consultants, turnkey suppliers also help select several key objectives, such as project timelines, production improvement, and expected return on investment that will serve as a guide throughout the implementation of the project to ensure maximum return on investment.
As production lines become more and more automated to keep up with the growing competition, it is increasingly important for food manufacturers to keep full control of all operations. To accomplish this and ensure smooth and efficient operations, effective electrical controls integration and reporting technology are essential. A service-led turnkey supplier can also support plant operators with software setup. Using a dedicated software package to fine-tune the proportional integral derivative (PID) loops and revisiting the original PLC control code will greatly improve the control situation.
"This can be achieved in many ways. For plants requiring more complex loop tuning, the use of predictive and adaptive systems, such as a model-based controller that sits above the PLC control loop on its PC-based platform can be feasible. Using these models, the system predicts the direction the process is taking and makes corrective actions before production can deviate from its set points. A turnkey solutions supplier with broad controls and integration expertise provides invaluable knowledge and advice to plant managers on the best systems for their line when this process is carried out," the tna expert mentioned. Once the system is up and running, it is important to make sure it operates at the maximum level of performance at all times. Even the most reliable equipment will eventually require maintenance, re-tuning, or upgrading. Moreover, as food production equipment becomes increasingly

By analyzing the customers' needs, their existing assets, and operational requirements, project managers can develop a tailored solution that is on-time, on-budget, and causes minimal disruption to the rest of the business.

sophisticated, general knowledge of food engineering is no longer enough when it comes to technical maintenance and operation.
"As a result, many full-service turnkey solutions providers include after-sales technical support and training modules in their packages, so that every aspect of the machine that might need attention is covered," he concluded.

AT KUIPERS, THE MAIN SOLUTIONS ARE DELIVERED AS TURNKEY

Valeria Lucinschi, business development manager at Kuipers, recently declared for Potato Business that the main solutions her company is delivering are turnkey projects.
"We believe this to be an important aspect of our technology as it allows us to ensure efficient integration of various components within a line. In addition, we aim to pre-test all our plants before shipment. Efficient pre-testing can only be done when a plant is delivered in turnkey execution. When it comes to potato processing, the main solutions we offer are chips and French fry lines. These include various types of chips such as kettle-style or hard bite and either frozen or chilled French fries," Lucinschi mentioned. Kuipers' representative added that a turnkey solution is essentially related to automation and automation means increased efficiency and a decrease in long-term costs. A processor should invest in a turnkey solution when they decide they wish to avail of these benefits.
"Each line should be customized according to the specific output. There are parameters within a system that must be in place for the snack producer to have any results at all. Customization of systems like ours comes from two sides, the design and the process. The design is the essential base that must be in place and agreed upon according to the end product output. The process, on the other hand, is a molding force. It can be applied conventionally or fine-tuned to achieve different outputs. A great example of this is Kuipers' multi-injection points frying system. A system that allows for great control over energy inputs throughout the length of the fryer. This gives the chips producer a unique opportunity to tweak temperatures and produce different types of chips, for example, kettle-style chips," she mentioned.
The company's expert added that for minimizing maintenance downtime, a better solution would be to prevent it in the first place. Ensuring the equipment is of the highest quality is the first step towards long-term usage. It is also important to operate a line in a way in which it was intended to be used.
"At Kuipers for example we ensure that staff on site is well trained and knows how to prevent any potential issues beforehand. Sometimes, however, maintenance-related downtime is inevitable. In this case, we have our field service engineering team, which is there to support our clients throughout the machine's lifetime. In addition, when a turnkey project is sold, most units are integrated and controlled via our advanced PLC system. Our engineers, therefore, can access the machine remotely and make adjustments to solve disruptions from a distance. This ensures rapid attention is given to any problem to prevent bigger issues," she concluded.

3D design layouts of equipment can facilitate the pre-building process and keep downtime to an absolute minimum during installation.

DECIDING TO INVEST IN A TURNKEY LINE

For many potential customers, the decision to invest in a turnkey line comes at a time when they are growing their business successfully. The decision can be influenced by many factors. Sometimes it is because they do not have the time and resources to dedicate to the project themselves. Often it can simply be because they want to avail themselves of the industry's expertise and worldwide support in engineering, project management, and after-sales service so they can maximize the quality of their investment.
"We are unique in how we can support such turnkey projects," says Bobby Kane, general manager, UK, Western Europe, and Middle East Regions, Heat and Control. "We can work with all clients, both large and small, who may need to 'customize' a line for many different reasons. Lack of space available in the facilities of the food processor is one of the most common problems faced. We work with our clients to provide the best solution to overcome these obstacles and this often involves custom design changes to accommodate and fix the problem."
The company's expert also tackled some of the challenges in integrating turnkey lines with other upstream or downstream equipment. In his opinion, interface points both mechanically and electrically are an area that can be very challenging. For this reason, open communication is extremely important between the customer, the existing equipment supplier(s), and the new equipment line supplier. If this is done well and all parties have "buy-in" to the concept, then things can and should run very smoothly.
"We support our clients by ensuring the correct equipment is supplied for the planned process. We use experts in the field and work closely with them to ensure each person is well trained so that when handover happens, the line is running well and requires only the minimum recommended maintenance. If any issues arise, we support all clients, both on-site and remotely to resolve any issues that may arise," he concluded. ■

POTATO PROCESSING
INTERNATIONAL
2022 Feature Planning

1 JANUARY/FEBRUARY
Ad closing 17.01/Publishing 28.01

Key Exhibitors Road Map and Event Agenda

Processes
- Conveying systems and belts
- Pre-cleaning, washing, de-stoning

Expert View
- Conveyors and the transfer of potato products
- Remote maintenance and customer service
- Cutting technology advancements

Spotlight
- Cleaning and sanitation

Markets
- Western Europe

Products
- Better for You potato products

Ingredients
- Lowering salt sontent

Storage Special
- Handling potatoes to & from storage
- Bulk vs. boxed storage

Trade shows: Potato Expo I Jan 6-7, Fruit Logistica I Feb 9-11, International Potato Technology Expo I 24-25 Feb

2 MARCH/APRIL
Ad closing 14.03/Publishing 25.03

Key Exhibitors Road Map and Event Agenda

Processes
- Sorting
- Process monitoring
- Seasoning & coating

Expert View
- Optical sorting - increasing yields
- Automation - ensuring a reliable and flexible production flow

Spotlight
- Smart production & Industry 4.0

Markets
- Eastern Europe

Products
- Potato-based snacks, drinks and innovations

Ingredients
- Flavors and seasonings for chips and fries

Storage Special
- Automated climate control
- Potato monitoring & quality assurance

Trade shows: Anuga FoodTec I 26-29 Apr

3 MAY/JUNE
Ad closing 09.05/Publishing 20.05

Key Exhibitors Road Map and Event Agenda

Processes
- Cutting, peeling, slicing
- Energy and water saving
- Oil filtration systems & de-fattening

Expert View
- Precision in cutting equipment
- Sustainability in production

Spotlight
- Waste management

Markets
- North America

Products
- Local vs. international tastes in potato snacks

Ingredients
- Frying oils

Storage Special
- Power saving and sustainability
- Storage design and construction

Trade shows: WPC I May 30-June 02, Europatat Congress I 29 - 30 May, Snackex I 06-07 June

4 JULY/AUGUST
Ad closing 18.07/Publishing 29.07

Processes
- Blanching, frying
- Forming and extruding

Expert View
- Latest frying technology developments
- PEF applications and advantages

Spotlight
- Increasing efficiency in potato processing

Markets
- South America

Products
- Potato chips flavors, textures and trends

Ingredients
- Batters, coatings

Storage Special
- Sprout suppressants in storage
- Sensors and data gathering

Trade shows: Potato Association of America Annual Meeting I July, Potato Europe I 6-8 September

5 SEPTEMBER/OCTOBER
Ad closing 05.09/Publishing 16.09

Processes
- Cooling and freezing
- Dehydrating

Expert View
- IQF freezing for French fries
- Drying - innovation in selt and drum dryers

Spotlight
- Traceability along the potato value chain

Markets
- APAC/ANZAC

Products
- Frozen French fries in retail & foodservice

Storage Special
- Refrigeration and long-term storage
- Disease Management

6 NOVEMBER/DECEMBER
Ad closing 07.11/Publishing 18.11

Processes
- Turnkey projects
- PEF technology

Expert View
- Complete lines for processing
- Conveying systems & inspection tables
- Batch vs. continuous frying

Spotlight
- Increasing production capacity/Future-proofing processing operation

Markets
- Global market predictions for 2023

Products
- Flakes, pellets and mashed potatoes

Ingredients
- The future of potato snacks 2023

Storage Special
- Storage challenges and cost-saving solutions
- Store preparation and hygiene