Automation in the Convenience (Ready-To-Eat / Heat) Food Segment

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01 ___ Executive Summary

Rising global populations place an ever increasing demand on food. Expanding globalization further intensifies the demand for multiple cuisines [1]. This and the fact that food items are affordable when mass produced makes large scale manufacturing necessary.

However, the industry has tough safety standards to comply with, ones that manufacturers cannot neglect in the quest for mass production. Recalls are the worst profitability killer [2] in the industry where margins are already slim. Besides, recalls severely dent the company brand.

Automation is a viable and sustainable option for mass production and packaging of food items while adhering to standards and making decent profits. The food industry was a late entrant in the automation arena partly because of the inherent variations in raw material shape, size, and quality aspects [3].

But the need to automate always existed with most manual operations in the food industry being repetitive, fast, and monotonous. This led to deficient quality control, low motivation, and high occurrence of accidents, which escalated expenses [3].

Convenience foods (Ready to Eat [RTE] and Ready to Heat / Cook [RTH/C]) have been popular in the developed world since long now. Their inroads in the emerging markets such as India is a rather recent phenomenon [4]. Among the most popular RTE/C dishes in India are Paneer, Rajma Masala, Chana Masala, and Pav Bhaji.

Fuelling the demand for convenience foods are busy urban lifestyles that make it hard for many to cook regular meals. Working population numbers have climbed, leaving them little time for cooking. Disposable incomes have risen and so have the per capita expenses on food.

It is for these reasons that Statista estimates the 2022 revenues of the global convenience foods industry at $588.9 billion. These very factors will expand the market at a 5.64% rate over the 2022-26 period [5]. Data Bridge forecasts the worldwide convenience and frozen food market to expand at 5% from 2022 and be worth $344.76 billion by 2029 [6].

Robust packaging is crucial for convenience foods for they need to last for the duration of the shelf life. Retort pouches made of composite material are preferred for RTE packaging as they combine the benefits of boil-in-bags and metal cans. Furthermore, brine addition is not essential for food in retort pouches. RTH/C foods use different packaging materials based on specific requirements.

While these foods are convenient as their name rightly suggests, their excessive consumption may not exactly be in the best interests of health. Besides, they are more expensive than freshly prepared meals. Moving ahead, their composition in terms of natural and organic ingredients will be more important.

02 ___ Convenience Foods: Global Market in the Context of Pros & Cons

Across the world, more and more people are entering the workforce. They have to spend a greater part of their work day in office as well as commuting to and from it. A result of such busy lifestyles is the limited duration available for cooking meals. This is the primary reason why convenience foods are replacing traditional cooked meals.

Statista estimates the 2022 revenues of the global convenience foods industry at $588.9 billion. Over the 2022-26 period, the market is expected to expand at 5.64% [5]. Data Bridge forecasts the worldwide convenience and frozen food market to expand at 5% from 2022 and be worth $344.76 billion by 2029 [6].

Here is why the worldwide market for RTE/H foods is booming:

• Busy, urban lifestyles in combination with an increase in working populations [7] leaves precious little time for people to prepare regular meals.

• Families these days are increasingly nuclear [8] with no member of the extended family available to cook regular meals.

• Many young professionals live alone [8] and have to depend on RTE/H foods.

• Rising disposable incomes per capita allows people to spend more. This has to be seen in conjunction with the expanding per capita spending on prepared foodstuffs [7].

• Greater acceptance of convenience foods [6] is in tune with the increasing penetration of Western lifestyles [8].

• More investments in cold chain development [6] ushers in technologies for safer and better storage of frozen food, making them more acceptable.

• Retail industry digitization simplifies the ordering process [6].

• Advances in packaging [9] make it safer to consume convenience foods. This factor is related to the cold chain development one.

• Addition of natural and organic ingredients [9] to foods makes them healthier.

These, growth-triggering factors are premised on the benefits of convenience foods. The

word “convenience” is a part of their name and also their fundamental trait – they make eating easy. Following are the reasons why people consume RTE/H food items:

• Prepared easily and quickly, these are a favourite with busy individuals particularly if they are inexperienced cooks [4].

• No planning is necessary to buy or store ingredients [10].

• Shelf stable RTE/H foods last much longer than freshly cooked food even without refrigeration [4].

• More than just being convenient to prepare, they are simpler to procure, consume, and clean up [4]. Easy to clean because they leave little or no leftovers. This is also why there is less wastage associated with them [10].

In order to make RTE/H foods “convenient,” they are subjected to various processes, which, though necessary for achieving the required shelf life, introduce a downside. Convenience foods:

• May contain more-than-necessary amounts of salts, sugars, saturated fats, triglycerides and other such ingredients that can be detrimental to health [4].

• Could have lost necessary nutrients during processing [4].

• Are, by their very nature, less fresh than homemade preparations of vegetables and fruits [10].

• Can be more expensive than freshly prepared food [10].

And hidden within these limitations are the reasons that can place roadblocks in the steady growth of the convenience food sector. These are:

• Health concerns top the list [11], and as people become increasingly health conscious, they will limit the consumption of convenience foods to the natural and organic variants. Knowledge of the use of preservatives in RTE/H foods, for example, scares away people from consuming them.

• Strict regulations is among the definitive features of the food industry. These are getting more demanding [9] with greater public awareness. Many producers will find it tough to comply.

• Deficient infrastructure for storage will limit the quantities that are available for sale [9]. This is particularly true for cold storage capacities in under developed economies [6].

Customer is the king of the market. With rising health consciousness, users will opt for convenience foods with more natural and organic ingredients. Regulations will follow consumer preferences or might even precede them. These factors could make maximizing shelf life less important than before for RTE/H makers as the focus shifts to health.

03 ___ Types of Convenience Foods

Convenience foods have been popular in the developed world since long now. Their inroads in the Indian market have been a rather recent phenomenon [4]. Also called tertiary foods, convenience foods are those processed foodstuffs that are easy to acquire, consume, and clean-up. This definition excludes raw edible fruits and vegetables.

These foods are classified in various ways. Based on whether they need to be prepared before consuming, convenience foods can be:

• **Ready to Eat (RTE)** food products that require no preparation and are consumed directly:
  ◦ Chips and bakery products [7].
  ◦ Animal and meat products viz. cheese and precooked chicken [12], meats, ham, and sausages [4].
  ◦ Dry foods such as cereals, nut mixes, crackers, and candy [12].
  ◦ Canned foods such as fish, meats [12], pasta, and soups [4].
  ◦ Fast food and restaurant food, the former being served faster.
  ◦ Beverages such as juices, soft drinks, and milk [4].
  ◦ Jams, pickles, marmalades, sauces.

• **Ready to Heat / Cook (RTH/C)** require some preparation:
  ◦ Curry mix, snacks mix, dessert mix [7], and cake mix [4].
  ◦ Pasta variants such as macaroni, noodles, and vermicelli [4].
  ◦ Pasteurized and packaged milk.

Based on how they are stored, convenience foods can be [4]:

• Frozen
• Shelf Stable

RTE and RTH/C foods can both be either frozen or shelf stable. Speaking of storage conditions, storage temperature for meats is at or below 41^0F [12]. That for canned products is 50-70^0F [12].

Another way of classifying them is the level of efforts that goes into their making [4]:

• **Basic RTE/H Foods** such as frozen and concentrated juices, instant vegetables, canned vegetables and the like made from a small number of ingredients.

• **Complex RTE/H Foods** contain multiple ingredients that are blended via longer processes. These include frozen foods, curry mixes, dessert mixes, and so on.

• **Manufactured RTE/H Foods** are made in factories and not in homes on account of the intricate procedures involved. As a result, they are costlier. Examples include breakfast cornflakes, aerated beverages, and RTE cereals.

Among the most popular convenience preparations in India are [7]:

• Paneer
• Rajma Masala
• Chana Masala
• Pav Bhaji

Certain specialty foods are convenience foods. Specialty foods are high quality foods renowned for cultural or ethnic origins, authenticity, particular traditions or processing styles, or top notch ingredients. They are usually in short supply. Types of specialty foods include [13]:

• **Probiotic Foods** that improve microbial balance of intestines.

• **Functional Foods** contain greater quantity of required nutrients such as protein or fibre.

• **Weaning Foods** enable the transition from bottle or breast milk to solid food for infants.

Convenience foods are an integral part of the daily lives of city dwellers at least. Take the case of pasteurized and packaged milk for example which they use regularly. Because some specialty foods are convenience foods, it is not that all of them are less healthy. Even otherwise, the importance of healthy ingredients in convenience foods is on the rise.

04 ___ Packaging Convenience Foods

Microbes, chemical reactions inside foods that attract microbes, and physical damage due to improper storage and handling are the major causes of food spoilage [14]. Dehydration, refrigeration-freezing, and canning are the three methods generally employed to counter spoilage [15].

Packaging is especially crucial for RTE/H foods because it is supposed to preserve their edibility for the duration of shelf life. Packaging material and procedures depend on a host of factors that include [16]:

• Required Shelf Life.

• Product Shape & Form: Whether food item is smooth, regular, irregular, or has sharp edges.

• Food Type & Ingredients: Proteins, moisture, flavour, fat and other such elements.

• Product Texture: Elastic, brittle, crisp, sticky etc.

• Biological & Abiotic Spoilage Factors: Microbes and chemical reactions respectively.

• Processing Conditions: Duration and temperature.

• Ambient Conditions: Humidity, light, temperature etc.

• Whether Retort Processed or Not.

Retort Processed: RTE foods such as rice, biryani, upma, dal fry, and palak paneer are retort processed [16] i.e. subjected to sterilizing heat treatment after packaging inside hermetically sealed, multilayer pouches [17]. Gas-flushing removes oxygen from the headspace of the pouch before packaging [16].

It was in the 1970s that the US army devised retort pouches as a preservative-free alternative to store soldiers' rations without refrigeration. Their capacity to impart an up-to-18-month [18] shelf life to food items radically transformed the food industry.

Also called Autoclaves or Sterilizers, retorts use steam or water to heat the pouches to between 110^0C (230^0F) and 135^0C (275^0F) [19] at high pressure and hold them there for predetermined durations of up to 30 min [18].

Retort pouches also integrate the benefits of boil-in-bag and metal can. Boil-in-bags contain packaged food and users can directly place them in boiling water for a prescribed

Composite Material	Features	Applications
Foil (9 mm) – Adhesive – Paper – Composite Micro Wax – Tissue (20 gm per m^2)	Low water vapour transmission rate (WVTR)	Biscuit overwrap
Foil (9 mm) – Adhesive – Paper – Extruded Polyethylene	• Blocks moisture • Machine friendly	Soup etc. packing in fin sealed sachets or pouches
Foil (9 mm) – Adhesive – Paper with Heat Blocking Vinyl Resin Coating	• Blocks moisture • Machine friendly	Confectionary overwrap
Polyethylene (1 inch) – Foil (9 mm) – Adhesive – Paper	Heat seals as wax bleeds via tissue	Confectionary overwrap
Foil	• Machine friendly • Good WVTR	• Confectionary overwrap • Biscuit overwrap
Cellophane layer – Adhesive layer – Pliofilm layer	• Transparent • Blocks gas	• Nuts in inert gas packages
Cellophane layer – Wad layer – Cellophane layer	• Sandwich printing • Good WVTR • Machine friendly	• Hygroscopic material in pouches / bags
Cellophane – Polyethylene	• Trapped printing • Blocks gas	• Chocolates
Polyester layer – Adhesive layer – Foil layer – Polyethylene layer	• Retains aroma • Blocks gas • Rigid • Heat resistant	• Cans – process-able and flexible
Polyester Film – Polyethylene (saran coated)	• Seals positively • High strength	• Food pouches (vacuumed)

Table 1: Composite Materials for Packaging RTE Foods [16]

time to cook the food inside. These bags can be solid for refrigerated storage. Perforated versions usually pack grains.

Again, retort pouches are superior alternatives to food cans as adding brine is not necessary [16]. Canned foods are brined i.e. dipped in salt solution to check proliferation of organisms that poison foods. *Clostridium botulinum* is a particularly notorious food poisoning microbe for it can withstand extreme heat [20].

Steel is the dominant material for solid food cans that have a thin tin layer. Mould-ability makes aluminium cans popular for packaging beverages [21]. Retort pouch material is:

• Flexible

• Tough

• Machine friendly

• Heat resistant as they have to withstand retort temperatures of up to 135^{0}C

• Puncture resistant

• Heat sealable

Among the popular materials used for flat retort pouches in India is PET – Aluminium Foil – PP 3-ply Laminate with 12, 12, and 75 micron thickness of the respective materials. Stand up pouches use laminate with 12, 9, 15, and 60 microns respectively of PET, aluminium foil, OPA, and PP [16].

Other materials suited for retort pouches to store moisture-rich Indian foods include [16]:

• Ethylene Vinyl Alcohol

• Nylon

• Polyvinyledene Chloride (PVDC)

• Silica-coated Nylon

Following are the chief merits of the retort pouches over metal cans:

• Equivalent shelf life with minimal interaction between container and product [22].

• Thin pouch profile saves up to 60% energy [16] and 30-40% time [22] during heating.

• Lower heat exposure improves nutrient retention, aroma, flavour, and colour [22].

• Empty pouch saves 85% average space vis-à-vis empty can [22].

• Saves shelf and storage space [22].

• Lighter to handle [22].

• Simpler to open and safer for user handling [22].

Non Retort Processed: RTE Foods such as idli, pizza, pav bhaji, and dosas are not retort processed on account of their extremely short shelf lives. Packaging material for these needs to [16]:

• Withstand grease and odour.

• Permeate trace amounts of oxygen and water vapour only.

• Possess excellent physical strength.

Materials used for packaging these foods are [16]:

• Bag Pouches / Plastic Film

• Plastic Containers made via Injection Moulding

• Paperboard Cartons

RTC foods can be classified based on their composition or their moisture content. The packaging requirements of each type are different. Here are the general requirements of packaging materials for RTC foods [16]:

• **Poor Gas (Oxygen, Air, & Nitrogen) Permeability** prevents:
  ◦ Food oxidation that causes flavour loss, rancidity, and discoloration.
  ◦ Loss of volatile essential oils and flavours that provide the desired taste and aroma.
  ◦ Loss of nitrogen from the container (pouch, can, pack etc.). Nitrogen is added to create an inactive ambience which protects foodstuffs from air or oxygen.

• **Minimal Light Permeability** ensures that light does not accelerate the oxidation of fats and flavours. Aluminium foils, pigmented plastics, cans, and metallised polyester block light.

• **Inert to Grease**, particularly for the innermost layer that is in touch with the food. This helps withstand fats and oils that may ooze out after reacting with the package. Polyester, polypropylene, cellophane, and inomer are good for this, HDPE and LDPE are not.

• **Appropriate Moisture Vapour Transmission Rate (MVTR)** as we shall see later.

Being compatible with machines is an important criteria for the packaging material. It has to because robotic automation is increasingly employed for food packaging. It provides high level of flexibility and is ideally suited for handling the repetitive operations involving a range of loads at greater productivity, food safety, and uptime.

RTC foods can also be classed based on their composition and moisture content:

Sr. No.	RTC Food Type	Examples	Observations	Packaging Material
1	Cereal Based	Dosa, idli, chakli	• Contain 8-10% moisture • Lose texture at 12-13% moisture	Polyolefin pouches, 37-75 micron thick for 3-4 months shelf life
2	Fat Heavy	Cakes, jamum, donuts	Turn rancid after reacting with water vapour and oxygen.	• CPP Pouches, 200 grams holding capacity for 2-3 month shelf life. • HD-LDPE or LDPE films for longer lives.
3	Pulses or Legume Rich	Khara sev, urad bath, vada, bonda	Packing material needs more moisture resistance than cereal-based ones.	PP and LDPE impart shelf life of: • 5-6 months at normal ambiences. • 1.5-3 months at high relative humidity and temperatures.
4	Enriched Spice Mixes	Soups, rasam, bisibele bath, sambhar		• Polyamide-core-co-extruded films. • PET or PE that is either metallized or plain. • Cellophane / PE.
5	Food Mixes	Tamarind sauce, orange peel gravy	Innermost layer must: • Block moisture. • Not react with flavours and fats	Copolymer of acrylic acid and ethylene with a co-extruded HD-LDPE layer as the innermost sheet.

Table 2: Packaging Material for RTC Foods based on Composition & Moisture Content [16]

Sr. No.	RTC Food Type	Examples	Observations	Packaging Material
6	Low Moisture Items	Have: • 1-5% moisture. • 18-20% Equilibrium Relative Humidity (ERH).	Packaging material needs below 1 gm/m^2/ day Moisture Vapour Transmission Rate (MVTR) to prevent moisture in-flow.	
7	Medium Moisture Items	Sweetmeats, salty-spicy foods with: • 6-20% moisture. • 65% max ERH.	Shelf life is more important than MVTR as these are prone to microbial spoilage.	
8	High Moisture Items	Sauces, cakes, breads, chutneys, pickles, chappatis with: • 20-60% humidity. • 85% ERH.	Vulnerable to: • Microbial spoilage. • Yeast or mould formations due to condensed moisture.	For: • Long shelf life: Retort pouches, cans, or aseptic packs after sterilization. • Short shelf life: LDPE that allows moisture to diffuse out.

Table 2: Packaging Material for RTC Foods based on Composition & Moisture Content [16]

05 ___ Requisites of an Industrial Cooking System

Anything related to food has to be invariably hygienic to ensure safety in consumption. People consume convenience food not just for its nutritional value, but also for its aroma and texture. Without a reasonably long shelf life, convenient food won't be very convenient.

Safety has another dimension – industrial – necessary on the factory floor. A system that uses minimal energy and cooks in the least possible time makes good returns for the manufacturer.

Desirable features of an industrial cooking system are:

• **Hygiene** as RTE items are not processed further before eating. The industrial cooking process has to, therefore, build safety into them. This applies partially to RTC items as well that are marginally processed (cooked) before eating.

Equipment such as kettles, buffer tanks, and buggies that are in direct touch with food need a smooth, inert surface that does

not react with foodstuffs and doesn't allow particles to stick.

• **Nutrient Retention** as RTE/C foodstuffs are prone to losing some of their nutritional value during various processes they are subjected to.

• **Aroma & Texture Preservation / Development** as these are important reasons why customers purchase convenience foods. Some brands may even have distinctive aroma and texture that they use as an USP. Apart from the ingredients used, the cooking and packaging stages influence these features.

• **Energy Efficient** so as to utilize least energy. Industrial cooking kettles operate at high pressures of about 45 to 50 psi [23] to lower the required energy.

• **Uniform Cooking** for product homogeneity. Industrial kettles have mixers / agitator arms inside to vertically and horizontally blend the food items inside for uniform cooking. Another tool for uniform cooking is isostatic pressing i.e. applying equal pressure from all directions to denature proteins and eliminate microbes [24]. Human bodies digest denatured proteins faster [25].

• **Industrial Safety** is of course the ever present practice on any factory floor. Practices and, more importantly, a culture of safety nips in the bud issues such as downtime, emergency repairs, and litigation, which can all be costly, complex, and lengthy.

• **Ergonomic** so as to ensure operator comfort. Buggies are operated manually for part of their operation have vertically staggered wheels for easy movement.

Automation is an excellent technique to fulfil these requirements. Quality and speed are the foremost advantages of automation in any industry. With robust equipment and smart systems to control them, human errors are virtually shunted out of the operation. Not the human intelligence though for it is ingrained into the system design.

By lowering human contact, automation drastically improves food safety. Automated cleaning systems further reinforce this advantage. Proper selection of cooking parameters will ensure that food automation systems preserve nutrients and flavour, the overarching concern among RTE/H food consumers.

06 ___ Automation in the Food Industry

A mix of proper equipment, skilled workforce, exacting quality control measures, and correct management practices are necessary to operate successfully in the food industry where stringent regulatory standards, low margins, tight competition, and seasonal demand spikes are the norm. Modifications in product lines are not infrequent [26].

Food industry has traditionally been a labour intensive industry with most manual operations being repetitive, fast, and monotonous. Such nature of operations has been the source of deficient quality control, low motivation, and high occurrence of accidents, which have escalated expenses [3].

While these realities create the need, the following factors make it tough to automate the food factory [3]:

• **Non-uniformity** in raw material shape, size, and homogeneity means designing standard devices and processes is a challenge. For example, individual units of meat, vegetables, and fruits are rarely identical. The dairy segment is an exception with high automation levels because milk is uniform.

• **Changes in Agronomic Conditions** can alter the chemical composition and physical characteristics of raw materials.

• **Novel Product Introduction** or changes in existing products based on market feedback modifies the process requirements.

• **Variations in Texture, Temperature-sensitivity, and Mechanical Strength** of food material make it difficult to standardize operations and gadgets.

• **Hostile Conditions on the Food Factory Floor** require special and therefore costly design for computers and electronics. Such conditions include wash down, temperature extremes, dust, and vibration.

Unsurprisingly, it is at the lower end in the list of industries that have adopted automation, a list topped by the semiconductor and automobile sectors. Technological developments coupled with the factors creating the need for automation have pushed the industry into employing greater automation [3].

Foremost among the advantages of automation are quality and speed. Here is what automation is delivering for the food industry:

• **Quality** is the prime reason for the food industry's foray into automation [3]. By **standardizing** the inputs, parameters, and processes while removing human errors,

automation delivers consistent output quality [26].

Automation of quality assurance operations became necessary when process automation boosted productivity as the manual methods of inspection are slow and cumbersome [3].

• **Productivity** through proper scheduling of labour use and work flow that enable efficient resource use [3]. **Traceability** or data recording facilitates monitoring the supply chain, production processes, and distribution chain with little or no manual inputs.

With this, technicians can identify issues and initiate remedial action, sometimes before something goes wrong. More than that, data analysis provides rich insights on overall improvement [26].

• **Profitability** rises following the improvement in quality and productivity as consistent quality and quantity of production promotes brand loyalty [3]. Also because quality improvement minimizes or even eliminates recalls, the top profitability killer for the industry.

• **Standards Compliance** becomes simpler with **traceability** easing the data recording process. Data from these records can be furnished to prove compliance [26].

• **Flexibility** as reprogramming machine software and repurposing its hardware is simpler than retraining employees. This is important to accommodate changes in response to modified product lines, standards, agronomic conditions and the like [26].

• **Industrial Safety** by freeing employees from hazardous tasks or locating them away from such environments. Machines are inherently better suited to handle repetitive, fast, and monotonous tasks of the kind prevalent in the food industry [3].

• **Efficiency** through better resource allocation and minimization of wastes, costs, and machinery footprints [26].

Standardization and flexibility are at the diametrically opposite ends. And yet, automation helps food product makers achieve both. This is substantial asset in that it provides the space for trial and errors to make products in tune with market trends. And once the recipe is finalized, automation standardizes it.

07 ___ Cybernetik's Ready to Eat / Heat (RTE/H) System

Cybernetik's RTE/H system delivers rapid cooking with nutrient and flavour retention. In view of the peculiar requirements of Indian cuisine, one device of the system can impart *tadka*. Recipe selection facilitates the preparation of multiple items and the system has in-built safeguards to minimize cooked material loss during power outages.
Expert, certified workmen build the system to the highest standards of hygiene, functionality, and safety while testing it thoroughly before dispatch. And with a self-cleaning CIP system that saves over 1000-plus litres (provisional figure) of water for every sanitization cycle, the recipe for seamless automation is complete.

Highlights

• Rapid and controlled cooking without loss of flavour or nutrients.

• Recipe-based raw material addition with facility to add minor ingredients.

• Completion checks without interruption of cooking.

• Systems for thorough mixing and preventing burn-on during cooking.

• Minimal loss of cooked material during electricity outages.

• Quick, efficient cleaning-sanitization with minimum use of water.

Safety & Hygiene

• Hygienic cGMP design.

• Ultra smooth finish for non-stick surfaces.

• Equipment doors locked during operations.

• Moving equipment travels only within set limits.
• Certified welders and professional workmanship.

• Complete testing for functionality and safety before dispatch.

Equipment

• Cooking Kettle
• Tilting Kettle
• Buffer Tank
• Buggy Lifter & Tipper
• Buggy
• Pouch Packer
• Retort
• Carton Packer for Pouches
• Carton Palletizer

Operation

Raw materials are loaded in the Buggy which is wheeled to the Buggy Lifter & Tipper. The latter lifts the Buggy upward to a set height before tipping it into the Cooking Kettle. A hose available on the raised kettle platform empties the Buggy completely and prevents wastage.

Cooking begins in the Cooking Kettle equipped with arms for thorough mixing and burn-on prevention. Tilting Kettle is where tadka is provided to certain foodstuffs. The preparation is loaded into a Buggy which is then emptied into the Cooking Kettle. A Brix Meter checks cooking completion without having to shut off the Cooking Kettle.

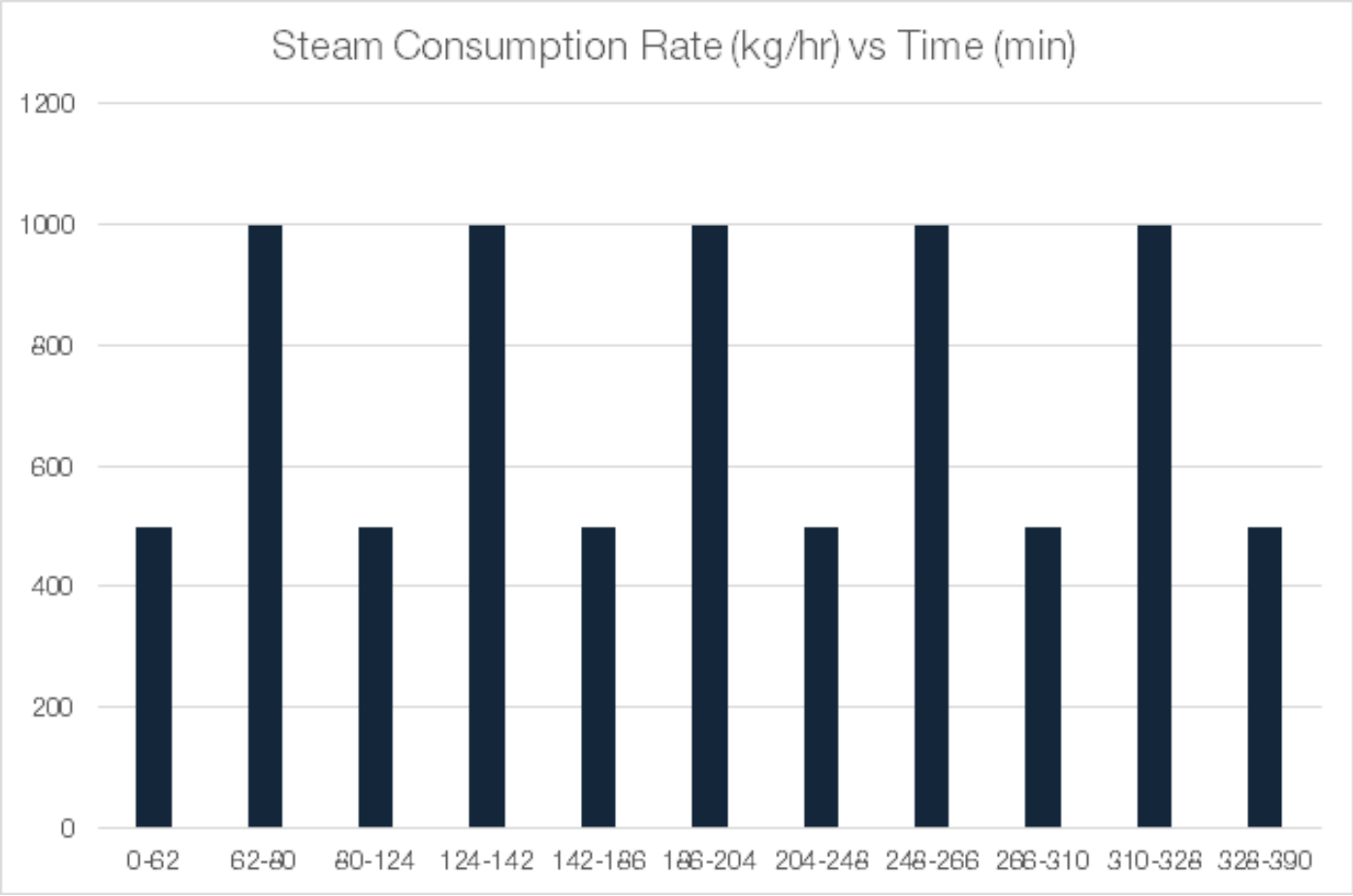
Buffer Tank is geared to minimize product loss during power outages. It offers insulated storage and gentle mixing of cooked material at the required temperature during power outages. Next, the Pouch Packer packs cooked material into pouches. These are then placed in Retorts and held at up to 1350C for a specified duration to improve shelf life.

Made of three plus three tanks (sometimes four plus four), the Clean-in-Place (CIP) system is designed for automatic cleaning-sanitization of Industrial Cooking System in full or part. It saves over 1000-plus litres water for a full cleaning cycle. CIP system also has a self- cleaning feature.

Standard RTE/H Solution

Cybernetik's standard RTE/H solution is optimized for quality and productivity through the integration of pouch packing, retort treatment, and secondary and tertiary packaging with the industrial cooking system. The entire system - from loading raw materials in the Buggy to final packaging – requires minimal manual inputs.

Two Cooking Kettles are connected to a common Buffer Tank. Downstream of Buffer Tank is Pouch Packer, Retort, Case Packer for Pouches, and Carton Palletizer. CIP System handles automated sanitization.



Plot 1: Steam Consumption (kg/hr) by the RTE/H System during a Shift

Cooking Kettles operate alternately with some overlap when both operate simultaneously. CIP System selectively rinses one Cooking Kettle while the other is operational to minimize downtime. If the system is delivering the same product, it is not necessary to rinse the Buffer Tank between batches.

This standard solution operates for six batches (three in each Cooking Kettle) in an eight-hour shift wherein the entire system is operational for 450 minutes, the last 30 min being used for a full system sanitization by the CIP System.

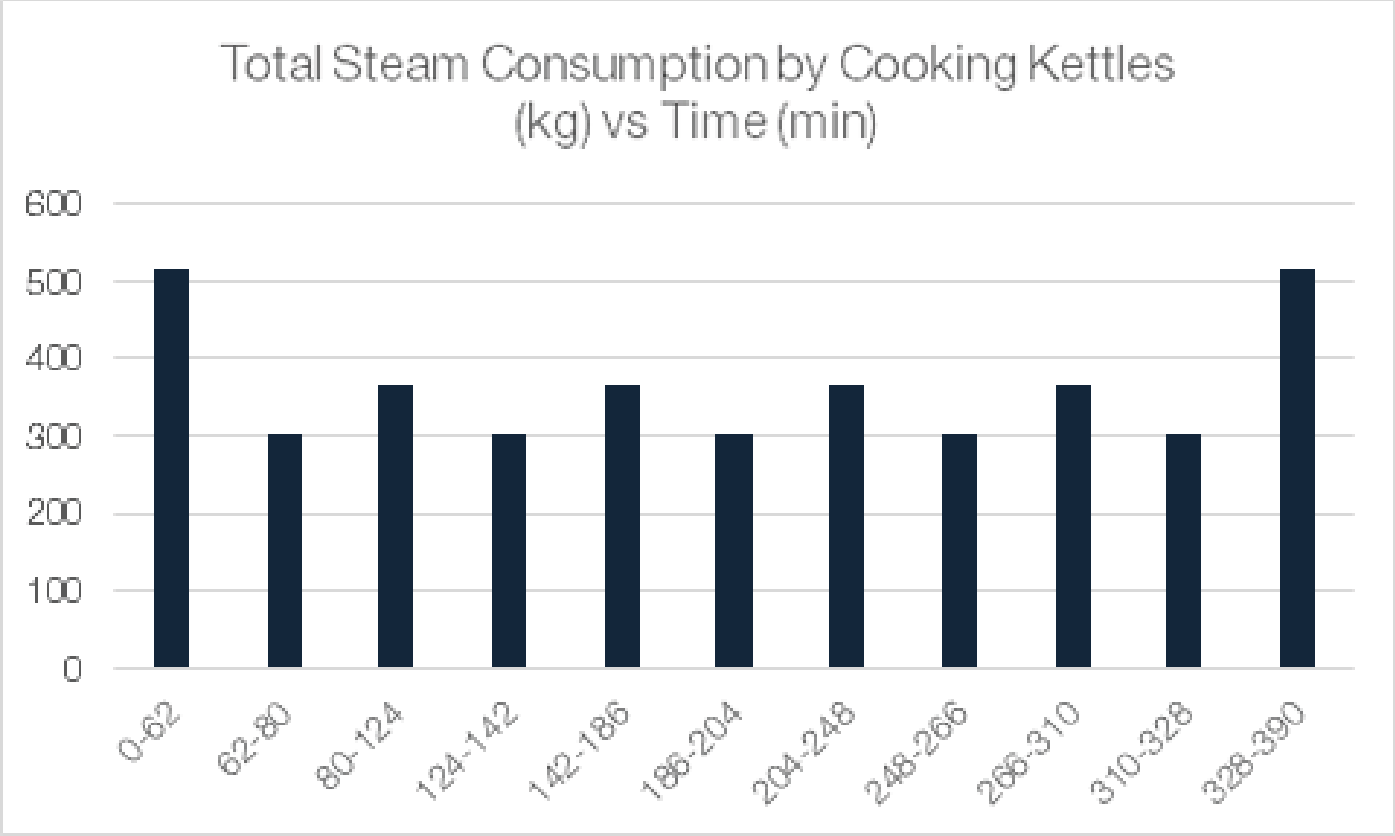
Each Cooking Kettle has an 80 minute cycle. This is how they operate in the shift:

• For the first 62 minutes, only one Cooking Kettle is active.

• Between 62 and 80 minutes, both are operational.

• From 80 to 124 minutes, the second one operates.

• Both operate between 124 and 142 minutes.



Plot 2: Total Steam Consumption (kg) during a Shift

• Only the first one operates between 142 and 186 minutes and this alternating cycle continues till 390 minutes.

Steam consumption rate is 500 kg/hr when one kettle is active and doubles to 1000 kg/hr when both operate. Total steam consumption during various durations in the shift is as shown in plot 2.

08 ___ Final Comments

Automation enables quality, productivity, and compliance in the food industry while also helping achieve the seemingly contradictory goals of flexibility and operational standardization. Although a late entrant, the industry is adopting automation and harnessing all its benefits as can be seen in the case of producing and processing convenience foods.

Cybernetik delivers customized RTE/H solutions for hygienic, productive, and efficient production that use minimal water for cleaning. Write to us at sales@cybernetik.com to know more on how we can automate your food production and processing plant.

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