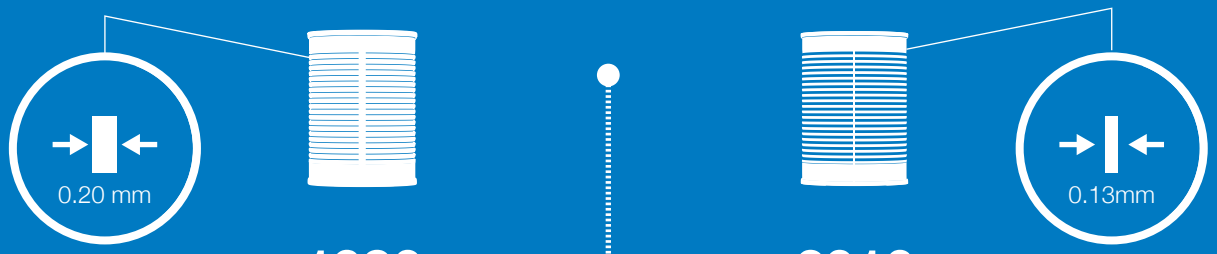
APEAL

30

30
YEARS
OF APEAL

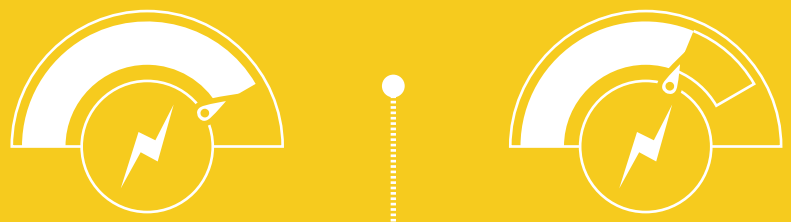
what a difference
30 years makes

a 3-piece food can is **29% thinner**



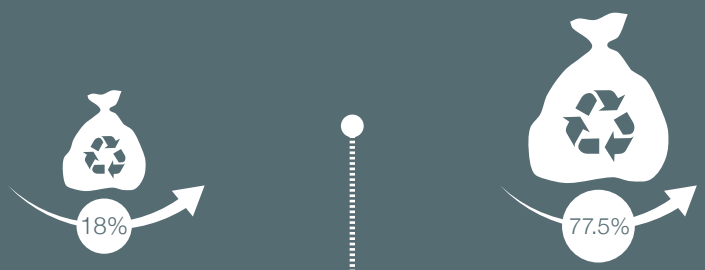
1986 **2016**

energy consumption in production is **25% lower**
(packaging steel including recycling)



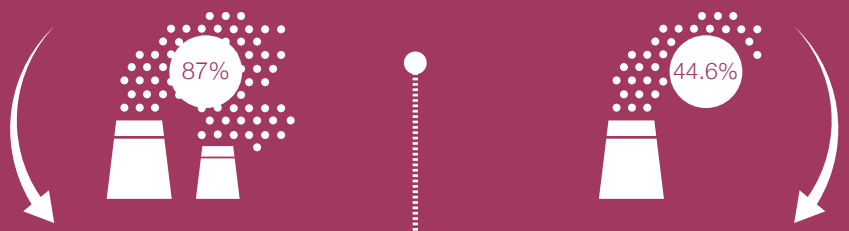
1986 **2016**

recycling rate **has tripled**



1986 **2015**

CO_2 emissions from production have **almost halved**



1986 **2016**

APEAL

http://www.apeal.org/**30-years-of-apeal**/

Message from the President

Since April 2016, APEAL has been celebrating 30 years of promoting the benefits of steel for packaging.

Our industry has made major strides, and steel for packaging is now recognised as a sustainability leader. The figures speak for themselves.

Over the last 30 years, we have reduced the energy we use to make steel for packaging by 25%. This has significantly reduced our CO2 emissions, which have almost halved.

We have also become more resource efficient, making more with less. So that can walls are an average of 29% thinner.

And our recycling rate has risen over 300% from 18% in 1986 to 77.5% in 2015. Steel packaging is now Europe's most recycled packaging material and has been for the last decade.

This is a fantastic achievement. However, more remains to be done and we are already looking to the next 30 years.

Implementation of the EU's Circular Economy Package (CEP) will be an opportunity to demonstrate the major contribution steel for packaging can make in helping achieve the EU's policy objectives.

For steel has a unique blend of inherent properties that make it a model material for the Circular Economy.

As a permanent material steel is infinitely recyclable with no loss of quality. It's easy to separate from any waste stream thanks to its unique magnetic properties. And because steel scrap is an inherent part of the production process for new steel, every single steel plant in Europe is also a recycling plant, saving resources, energy and emissions by recycling steel.

In addition, steel for packaging remains relevant to brand owners looking to protect and promote brands with a proven packaging format that consumers like and trust. Packaging products in steel helps to preserve nutrients, save food and reduce food waste.

These qualities have all been recognised in a series of essays by experts from the fields of environment & recycling, food & nutrition, and packaging design, commissioned to mark our 30th anniversary and included in this brochure.

I hope you will enjoy reading their thoughts about the future of steel for packaging.

I am confident that in 30 years' time we will all be enjoying the benefits of more sustainable and resource efficient economy and that steel for packaging will have played a key role in making that possible.

Stéphane Tondo,
President of APEAL

95%

of steel for packaging production

4.25 MT

in 2014

200,000

employees

5500 direct jobs

in steel for packaging

About APEAL

APEAL – the Association of European Producers of steel for packaging – is a federation of the four major producers of steel for packaging.

We are committed to working with all relevant stakeholders to ensure understanding and support for steel as a sustainable and resource efficient packaging solution.

ArcelorMittal TATA STEEL thyssenkrupp USS


Del Monte
Del Monte
GOLDE

Our objectives

- **Contribute** positively to the development of EU policy related to steel for packaging, particularly in the areas of packaging, waste, recycling and recovery.
- **Monitor** technical developments to ensure industry compliance.
- **Document,** support and communicate the environmental, social and economic benefits of steel for packaging.

About steel for packaging

Steel is a unique packaging material, combining exceptional performance capabilities with unrivalled environmental credentials.

Strong, formable and long-lasting, steel offers numerous benefits for the safe packaging of a wide variety of products.

APEAL

30

30
YEARS
OF APEAL

30 years of APEAL

To mark our 30th anniversary, several of Europe's leading environmental, packaging and food experts have shared their views about the future of steel for packaging.

Dr. Fredy Dinkel and **Flora Conte**, experts from the Swiss environmental consulting company Carbotech AG, have highlighted the role of steel as a permanent material in a circular economy.

Roland ten Klooster, Professor Packaging Design and Management, University of Twente, has confirmed the ability of steel for packaging to protect and promote brands.

Elisabeth Payeux, Deputy Managing Director of the French Technical Center for the Conservation of Agricultural Products, has highlighted how steel packaging's ability to preserve and protect food will become increasingly important in efforts to reduce food waste.

We hope you enjoy reading their views.

Steel – an ambassador of circular economy

Steel for packaging: the value of a permanent material in a circular economy

The production of steel can be traced back several thousand years and when our ancestors first began to use steel, they also started to recycle it. Indeed, steel has been recycled for thousands of years.

Today, as increasing pressure is brought to bear upon limited natural resources, research and development programmes continue to seek more effective means of recovery for all types of metals and alloys. New steel, however, continues to be produced from old steel, every day.

While the recycling of old steel in its many forms is a normal metallurgical process for producing new steel, today‘s food can could be recycled to become steel used for tomorrow’s train, car or skyscraper.

The process of recycling is being improved upon continuously. In turn this has boosted recycling rates for steel packaging significantly in recent years – in Europe steel packaging reached an all-time high recycling rate of 76% in 2014, a number that keeps increasing (APEAL, 2016).

Indeed, there can no longer be any doubt about the economic sustainability of recycling steel. But it is such a widely established, everyday process, we may forget just how significant a role steel recycling plays in tackling the environmental challenges the world now faces.

In fact environmental product life cycle assessments (LCA) show that using recycled steel to make new steel considerably reduces the amount of energy used and the environmental impact from pollutants by a factor of approx. five (Classen et al., 2007) compared to the use of new steel .

On a global scale, this reduction in energy consumption and the substantial cut in emissions which steel recycling enables, is highly significant. But the benefits are not limited to the economy or the environment.

The third pillar of sustainable development, society, also benefits from steel recycling. The social impact of products assessed with “social LCA” highlights large differences from country to country (Franze, 2011). In the European Union, steel is mainly recycled using clean technologies and following strict health and safety standards. In contrast ore mining, which typically takes

Picture courtesy of TATA Steel

place in developing countries, carries a greater risk of negative impact on the environment and the health of miners.

These are not the only reasons why it makes sense to recycle steel. Indeed, steel has been reused, melted and reshaped for thousands of years, not only because it is easier, cleaner and cheaper, but also because the iron and other metals used to make steel have inherent chemical and physical properties that do not change when recycled. This is significant because as a result, it is theoretically possible to produce new steel without any addition of virgin material.

European metal packaging stakeholders have therefore classified steel as a “permanent material” and interest in permanent materials has grown alongside the development of Circular Economy thinking.

However, in a circular economy, the use of permanent materials is about more than just the material's properties.

This is why Carbotech AG developed the Concept of Permanent Materials (CPeM) which is an approach designed to take into consideration both material properties and, for each application, material stewardship.

According to this concept, a material application can be considered to be compliant with the CPeM if it corresponds to defined material properties and by ensuring material stewardship when:

a. an application is technically available after use and recycling
b. recycling the material provides an added-value to sustainable development.

If these conditions are fulfilled, then a given application has the perfect potential for closed technical loops in a circular economy.

Chemically speaking, the inherent material properties of a metal do not change regardless of repeated recycling into new products. But beyond chemical and physical properties, it is crucial to determine whether the material application is available after use and recycling.

The range of iron applications is particularly wide and, whilst some of them may not yet be fully compliant with the permanent material concept: steel used for packaging is an excellent example of an application that complies with this concept.

Some steel used for packaging is plated with tin to protect against corrosion. Both metals are recycled during the closed-loop process and tin does not currently influence steel packaging recycling because the very thin layer of tin is diluted by the large amount of steel coming from various applications. As circular economy practices become more and more common, the steel recycling process should consider the best way of maintaining the 'tin-loop' to achieve the greatest environmental benefit for both materials (Kägi & Dinkel, 2015).

In addition, there are opportunities to further improve the recovery rate of steel packaging, which is currently nearly 80%. Inevitably some material is still lost to the recovery system after the consumer has used the contents of the packaging, but as collection infrastructure improves and more consumers recycle steel packaging, there will be opportunities to improve recovery rates. One question that remains is: how to maximise the ecological added-value of increased recycling given the additional environmental impact of collecting and processing more material. However, even if steel for packaging is mixed with residual waste that is incinerated with the remaining municipal solid waste, steel can be recovered from the bottom ash and recycled.

If we look beyond the concept of permanent materials, it is possible to see that the advantage of steel food and beverage packaging is not just limited to recycling but extends throughout the entire life cycle, particularly during use.

Indeed, the very function of steel packaging is to protect food and beverage products and to preserve them. And, as the LCA experts of Carbotech emphasise, the ecological impact of preserved food itself generally represents 90% or more of a product's impact. Packaging can even lead to a reduction of the environmental impact of food. During winter for instance, the environmental impact of 1 kg of green beans grown in a green house or imported from Egypt by plane is nearly three times higher than 1 kg of canned local green beans.

So, the benefits of using steel to package food and beverages can be seen to be wide ranging – it is a permanent material when material stewardship is provided, offers potential for the circular economy, and if every stakeholder is involved, represents a closed loop.

To fully realise the opportunity, today's consumers need to bring back and separate their waste, researchers must continue to develop more accurate and sustainable technologies and politicians along with industrial decision makers must support their use.

Authors:
Dr. Fredy Dinkel and Flora Conte, experts of the Swiss environmental consulting company Carbotech AG specialised of environmental assessments such as LCA and developers of the Concept of Permanent Materials.

For more information:
www.carbotech.ch.

Steel for packaging, designed for efficiency

Steel was first used as a packaging material more than 200 years ago.

Old images reveal that early design was very functional. The can was closed with a dome-shaped top with a ring attached to carry the can. It featured a hand-written label to identify the contents and where they came from.

This may have been a primitive design, but it had almost everything we'd recognise in modern packaging: protection, product identification, convenience and portability.

The steel can was a revolution in the world of food packaging, providing the first successful industrial scale conserving and packing of food.

As prosperity grew in the second half of the 19th Century, steel became the packaging material for many every day and luxury food products. The ability of steel packaging to preserve food indefinitely, combined with its strength and protective properties, meant canned products could be transported safely over long distances. As a result, demand was particularly strong from armies and navies who needed a reliable supply of nutritious food and from settlers in far-flung European colonies seeking a taste of home.

The excellent characteristics of the steel can were quickly recognised in other industries. The American, Sherwin Williams succeeded in making 'ready to use paint' packed in a resealable can and patented his invention in 1877. This was a totally new concept because previously paint had to be mixed freshly from harsh chemicals and pigment onsite and could not be stored. In addition, the can was resealable ensuring the paint could be used at a later date. This development highlights the ability of packaging to drive product innovation and development and to prevent product spoilage.

Whilst the ability of steel packaging to protect products, reduce waste and extend shelf-life

was key to its early success, the development of modern transportation infrastructure cemented its importance. The replacement of the dome with the now familiar flat top, allowed cans to be stacked, significantly increasing their efficiency through the distribution chain.

Further developments followed. In 1935 the first beverage can was invented. It was clearly inspired by a bottle with a crown cork, but it was the start of another evolution in the use of steel packaging: thinning of the plate and the concept of drinking directly out of a can.

A packaging material without rival

The characteristics of steel as a packaging material are such that still today no other material can compete with it.

Steel packaging provides an excellent barrier for gasses, humidity and UV-light, combined with high strength and heat resistance which together offer greater protection than any other packaging material. These characteristics have led to new uses such as pressurised aerosols for a range of household and personal care products, as well as extensive use for chemicals and industrial products.

Meanwhile process improvements in today's food industry mean that steel cans have become synonymous with high quality, nutritious foods – indeed canned vegetables and fruits are used as additions to meals for athletes before competition and canned fish is used in the highest quality restaurants across the world.

In turn, as greater and greater demands have been placed upon steel packaging, manufacturers have responded, through processes such as lightweighting which has seen a continuous thinning of the tinplate used to make cans without loss of shelf life or strength.

In the last 20 years, the weight of steel cans has been reduced on average by 33%. And the average thickness of 3-piece food can is down from 0,20mm in 1986 to 0,13mm. At the same time, many new shapes, sizes and opening mechanics have been developed so that today even consumers with limited mobility are able to open food packaging without using a can opener or other tools.

The decorative properties of steel for packaging are also important. Providing information about the can's contents and origin is an important function of packaging. It started with paper labels, but now cans can be directly printed. This gives the opportunity to use another characteristic of steel: the gloss. Many packaging materials reflect light and although the level of gloss can be adjusted by various surface treatments, the gloss of polished steel remains superior primarily because steel causes less scattering of light, giving a high-quality appearance.

By printing, embossing or the use of the gloss, innovative and sophisticated designs can be achieved. This enables brand owners to give the products 'shelf-standout' a vital marketing tool for many fast-moving consumer goods.

With more ‘time poor’ consumers than ever before, the ability of a product to stand out from competitors is vital. Brand loyalty is decreasing and the design of the packaging plays an important role in a pack’s ‘stopping power’ in the store. Using gloss is especially effective in attracting attention in-store.

Brands are increasingly using techniques such as embossing and debossing, often combined with matt lacquers applied to high gloss cans, to create packs that convince shoppers and have ‘holding power’. The way in which polished steel reflects light to create a high-quality appearance is an additional consideration for brands seeking to create this holding power. (See pack page 16).

The buying decision is finished by the “closing power”. Steel packaging has a large surface area making it well suited to branding and decoration especially with the use of pictures to communicate emotion combined with product claims such as ‘new taste’, 10% free etc. The combination of these elements creates the total image of the pack, which can be very powerful in persuading shoppers to purchase

The future of steel packaging

The future of steel for packaging looks promising, although there are a number of factors which will have an influence on its development.

In terms of design, two directions can be distinguished: luxury and authenticity. Steel can play a role in both. Matt appearance or the use of gloss, as well as printing directly on the can or using printed paper labels, all influence the final look and feel of a product. As a result of further work to thin steel, there may be opportunities to use steel for packaging fresh products as well. This will need some innovations in openability because consumers can have some reservations in accepting steel packaging, but new concepts will no doubt be developed.

Designers also use steel as the base for creating luxury packaging in which active elements like temperature indicators as well as UV and temperature sensitive inks for special effects are being taken up.

But the packaging market is volatile and packaging choices are not always based on rational facts alone.

Misconceptions about steel packaging persist, particularly in the area of sustainability.

Steel packaging has been the most recycled packaging material in Europe for the last 10 years. Yet many consumers are not aware of this high recycling rate. Indeed, not all consumers understand the differences in recycling rates and even for those that do there are few opportunities to choose products based on their packaging format.

However, the environmental concerns of consumers are growing and appear likely to

exert greater influence on their opinion and behavior than ever before. Given that steel packaging is able to reach the targets set by the European Circular Economy Package, this presents an ideal opportunity for the industry to reassert its excellent recycling performance in a way that engages consumers.

High recycling rates combine with many years of successfully reducing both the amount of steel that goes into making a package and the amount of energy used to make new packs. And further progress is ongoing. Yet the role of shelf life and its effect on food waste are not yet fully recognised in many Life Cycle Assessments (LCA).

To remain competitive in the volatile world of fast moving consumer goods, the industry must ensure that other benefits offered by steel packaging, such as long shelf life and reduced product loss, are more widely understood. Illustrating the possibilities to students who are destined to become our designers of the future, as has been done at the University of Twente in the Netherlands, is just one of many small steps required.

Steel remains an unrivalled solution for shelf life, transport, storage, use and recycling. Yet the design features and benefits of steel packaging must first be sold to the brand owners and consumers, to make them aware of the continual improvement in environmental performance that steel packaging provides.

Then there is every chance that the steel can which first appeared more than 200 years ago, will continue to protect and preserve our products for many years to come.

Author:
Roland ten Klooster, Professor Packaging Design and Management, University of Twente. Chair being paid by the NVC Netherlands Packaging Centre with support of twelve companies to raise the level of professionalism in the field of packaging

Designer/consultant at Plato product consultants. Executing structural packaging design on a higher level. One of the inventors of the Orbit cap (produced by Crown) and the Spring Latch (produced by Ardagh Group)

Living and eating well, with canned products

Steel cans revolutionised food packaging when they were created more than 200 years ago.

And since canning technology came of age in the 20th century, the can has provided a safe, effective and affordable means of preserving food and vital nutrients such as vitamins and fatty acids for millions of people.

Whilst many new packaging formats have been developed since its invention, the can has endured. Although some people might associate it primarily with staple food items or perhaps low value products, steel for packaging and the steel can will remain at the very centre of the food packaging stage for many years to come, providing high quality, nutritious and varied food stuffs for people throughout the world.

A time-tested process

The first canned foods appeared in the 19th century, driven by the need to preserve food on long maritime expeditions. They revolutionised sailors' diets and ended the problem of scurvy, thanks to the vitamin C partially preserved in the canned foods.

Today, canning technology allows us to preserve food and protect its nutritional quality for long periods at room temperature.

The process works by heating airtight cans to sterilize the food inside them, and it remains one of the most widespread and safest ways of preserving the health benefits of food.

Through the years this process continued to advance as research into the effects of heat treatment has improved our understanding, and the manufacturing process of tinplate cans has become more sophisticated.

In terms of safety, the process has stood the test of time. The modern packing industry is extremely well controlled and products and production facilities are subject to regular inspection, especially on a microbiological level. In the context of a risk analysis no case of botulism has been reported since 1918 among the 700 identified references. So, consumers can be confident about quality and safety when buying canned food.

One of the advantages of canning foodstuffs is that sterilization by heat does not modify the macronutrients, proteins, lipids and carbohydrates of the canned food.

As a rule, vitamins are preserved at the rate of about 70% in canned products which is close to the content in fresh foods that have been stored for several days before eating.

With modern farming, harvesting and packing practices, fruit and vegetables are canned very quickly after harvesting. Times of between two to four hours are common, thanks to the close proximity of many canneries to the cultivation areas.

This quick processing facilitates the preservation of most of the original organoleptic and nutritional qualities of the produce and limits the loss of water-soluble vitamins (C and Group B vitamins). Similarly, many types of fish such as salmon, tuna and sardines are canned shortly after being caught. The process also preserves their beneficial nutrients such as Omega 3 fatty acids which are largely preserved by canning.

Recent advances in research

In a bid to continue improving the process of canning foods, much research work has been carried out especially on how to further improve the levels of certain nutrients during the canning process.

Scientists have established that several important vitamins and nutrients are preserved by the canning process.

Green vegetables and folates

Folic acid or vitamin B9 plays an essential role in the production of genetic material (DNA and RNA) and amino acids needed for cell growth, which explains its essential role throughout the different life stages. It plays an important part in the formation of red cells, the functioning of the nervous system and the immune system.

Vegetable products, and in particular green vegetables, are the main contributors to vitamin B9 intake. Recent studies have shown that green beans and spinach keep about 70% of their folates during the canning process. The reduction is caused mainly while blanching, and is similar to what happens when cooking at green vegetables at home.

Tomatoes and carotenoids

Carotenoids such as β-carotene (pro-vitamin A) or lycopene are micronutrients that are beneficial for our health. Humans absorb these regularly when eating fruit and fresh or processed vegetables. However, their effectiveness is linked to the actual quantity absorbed by the body (bioavailability).

Studies have shown that the percentage of bioaccessible carotenoids present in canned foods is dependent on the temperature and production process used. However, the presence of fats, as in the case of tomato sauces in cans, promotes the release of carotenoids and improves their absorption.

Vitamin C and resistance to heat

Little has been documented about the breakdown of Vitamin C at temperatures usually used for sterilisation (over 100°C) due to a lack of sufficient instrumental capacities.

Very recently, thanks to the application of an experimental mechanism that allows continuous measurement of the breakdown of vitamin C during thermal processing (stimulating a sterilization process), the role of the availability of oxygen was identified as a key point in controlling nutritional quality.

In a model solution, even after five hours heating in the absence of oxygen, regardless of the initial concentration or the temperature (up to 125°C), vitamin C does not disappear completely. It should be noted that the time of industrial processing is usually several minutes, maybe about 10 minutes.

The results obtained with apple and carrot purée showed that the breakdown mechanism of ascorbic acid was complex and involved several simultaneous and successive mechanisms. We can therefore assume that reducing the presence of oxygen when canning can help preserve vitamin C.

Dried beans and lentils

The effects of steaming or canning vegetables such as kidney beans, chickpeas and green and brown lentils have also been studied.

Whilst the steamed vegetables retained higher levels of proteins, fibres and micronutrients, they had lower levels of lipids and carbohydrates. Canned beans and lentils, however, proved to be easier for the body to digest and had higher levels of vitamins B6 and B9.

This opens the possibility for the development of new products such as canned steamed vegetables where the vitamin content will be even better preserved.

Benefits in sustainable food systems

As well as extending the shelf-life of food and preserving many important nutrients, canning food has many benefits in the fight against food waste, which is a major challenge today and tomorrow.

Steel cans are available in multiple formats that can be adapted for different types of consumption, from small single serve cans to large catering packs. The right size pack is essential in managing consumption and greatly contributes to reducing food waste.

In terms of energy consumption, canned food also has the advantage of being stored at room temperature from warehouse, through the supply chain, on-shelf and in the home or restaurant. Preservation is therefore maintained without the use of more energy.

Also, when it comes to carbon footprint, canning facilities are generally located close to cultivation areas or fisheries, which greatly reduces transport costs and thus the carbon footprint of the cans.

The future

So what about the future? Recent studies on the nutritional quality of canned foods promise some interesting developments such as:

- The implementation of the process of reduced oxygen content to preserve vitamin C and other beneficial molecules
- The development of products adapted to specific target groups (young children and older people), taking into account their nutritional needs
- Improvement of organoleptic qualities of new products by, for example, playing on the intensity of thermal processing and formulation
- Development of new products with beans and pulses for which canning has a strong advantage in terms of practicality
- Combining innovative and/or conventional processes on single operations to improve the industrial line in general and the overall quality of the products.

In future, the canning sector will no doubt move to an ever more integrated approach between agricultural producers and retailers, with research on the relationship between quality indicators for raw materials and those for finished products.

The aim is to have better production guidance, to limit waste of food and to have even better quality products.

In addition to being practical in terms of use and storage and their quick preparation, canned products also deliver benefits in terms of quality and flavour, nutritional and safety levels.

Their relative low price is also an effective argument to encourage people to eat more fruit and vegetables. The variety of products on offer to the consumer also means that people can devise varied and original menus and enjoy the pleasure of eating and sharing, two essential and complementary elements of “Eating Well”.

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