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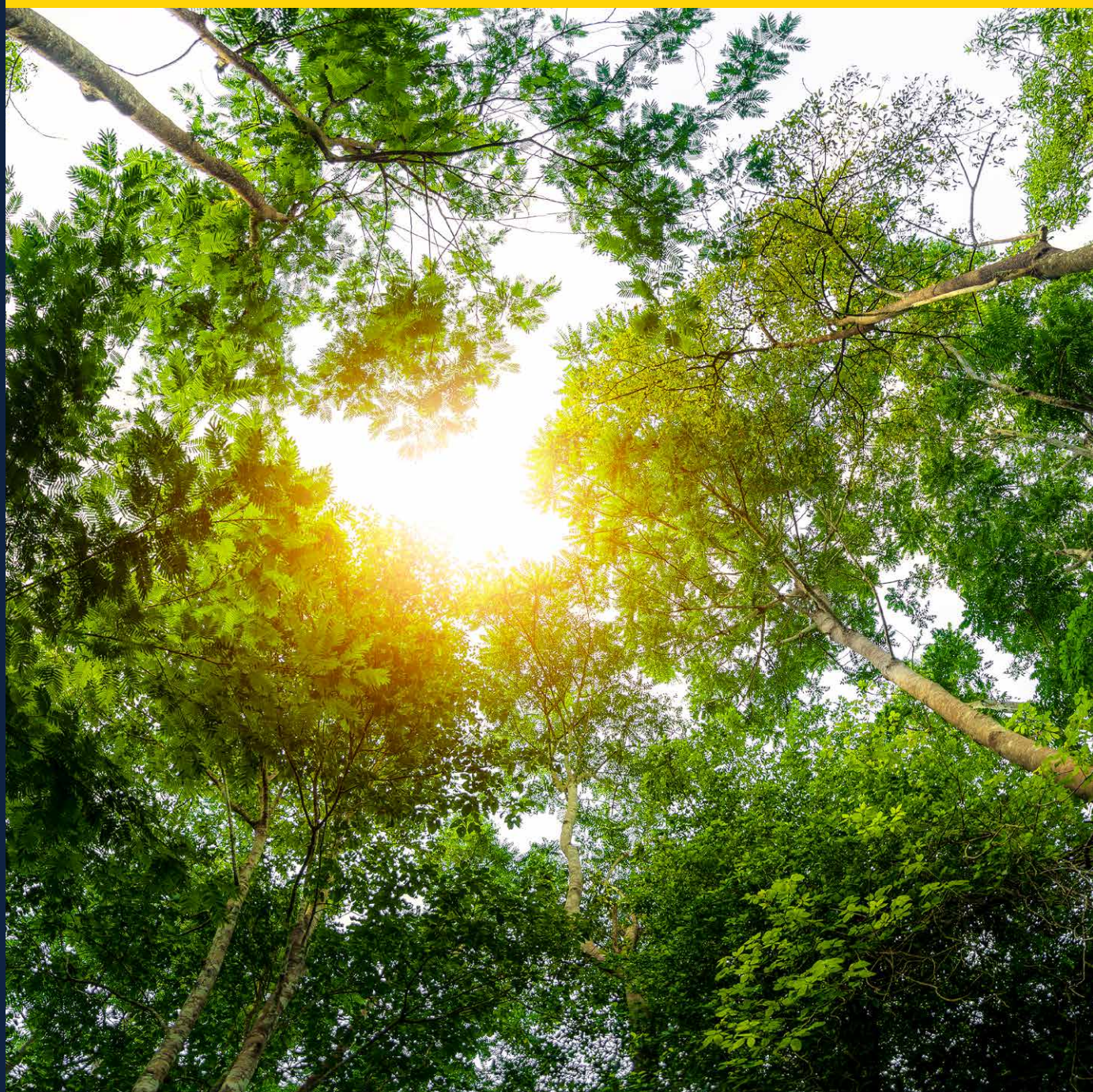
How NFC can help your business become more sustainable



Foreword

As brand owners, product developers or packaging designers for consumer goods, sustainability is becoming an essential dimension. It is also an opportunity for entrepreneurial innovation.

Now available in most smartphones, NFC technology connects products to the digital world while enabling innovative sustainability initiatives. It uniquely allows batteryless, wireless communication using one single electronic component: the chip.

This whitepaper explains how sustainability matters in today's world, for both consumers and brands. It describes the obstacles of today's circularity initiatives and provides prospects for improvement.

You will learn how leveraging NFC technology can support various sustainability initiatives. It also gives several examples of applications and demonstrates how all stakeholders, from brands to consumers, and all throughout the product lifecycle, can take advantage of the technology when it comes to environmental initiatives.

Within the framework of consumer goods, NFC technology used for sustainability purposes can bring value to stakeholders when associated with products that:

- Have a complex composition, are made of several components and materials
- Provide traceability services and tracking features
- Are likely to change ownership (second-hand market, for instance)
- Are durable over time and will therefore lead to multiple uses
- Can be refilled, repurposed, or recycled

Overview of sustainability today

Over the last decade, people from all over the world have become more sensitive to sustainability issues and are aware of the fact that we must act rapidly to make things change.

Having such concerns in mind, companies want to make a contribution toward sustainability, starting by better understanding consumer behavior.

In the same way, sustainability is a matter which is now taken into account by companies that were not previously engaged in an environmental path.

> Nearly 80% of consumers say that they want to be able to make a difference in saving the planet for future generations and 66% choose to purchase products or services based on their "environmental friendliness."
>
> On the companies' side, 90% of executives surveyed say that sustainability is highly important for their industry and 66% say that sustainability is fully integrated into their business objectives.*

Today, sustainability and recycling considerations are no longer dedicated to a small number of companies throughout the world. Small enterprises as well as global groups are now seriously taking this subject into account in their corporate strategies in order to act for a greener future.

Environment is therefore a key consideration and companies from all industries are involved in this path.

* Source: https://www.capgemini.com/wp-content/uploads/2020/07/20-06_9880_Sustainability-in-CPR_Final_Web-1.pdf

Circularity towards a greener future

13.5 %[1]

This represents the recycling rate of waste in the world. Compared with the 2.01 billion tons of global waste that was generated in 2016* and expected to increase drastically in the coming years, it is high time to find solutions to improve recycling rates and circularity throughout the world.

WHAT ARE THE OBSTACLES TO ADOPTING A MORE SUSTAINABLE BEHAVIOR?

In general, several reasons are suggested by surveys but the most common obstacle is the lack of convenience. As confirmed by 41%[2] of respondents, people do not know how to participate in recycling programs and recycling is often inconvenient.

This is due to:

- A lack of infrastructures, forcing people to travel long distances to recycle their goods
- A lack of information regarding the product's recyclability and how to proceed (need to separate the different parts of the product, recycling locations, ...).

If the first aspect is not always easy to deal with, for the second one, on the contrary, there are solutions to solve the problem and to provide consumers with clear and consistent guidelines about recycling. And why not use technology to do this?

A NEW ERA IS COMING

More than ever in the 21st century, sustainability is at the center of all preoccupations.

Indeed, we have now entered the Fourth Wave of Environmentalism, a new era led by innovation as a way to solve environmental issues.

We are surrounded by new technologies and it is now imperative to leverage them to protect the environment and create safer, smarter, and greener ways of living.

Everyone, from companies to consumers, can help contribute to a better world.

ST's commitment to sustainability is part of our DNA for more than 25 years. Today, our comprehensive roadmap to carbon neutrality includes compliance with the 1.5°C scenario defined at the Paris COP21 by 2025, which implies a 50% reduction of direct and indirect emissions compared to 2018, and the sourcing of 100% renewable energy by 2027.

WHAT IS THE FOURTH WAVE OF ENVIRONMENTALISM?

Today, we are witnessing a Fourth Wave of environmental innovation driven by new powerful and accessible digital technologies that provide new insights and empower us to tackle the most urgent environmental challenges.

- First Wave environmental innovation protects our lands
- Second Wave environmental innovation uses the law to protect people and nature
- Third Wave environmental innovation harnesses business and markets
- Fourth Wave environmental innovation empowers everyone

Source: https://www.edfeurope.org/fourth-wave-environmentalism

[1] Source : https://www.worldbank.org/en/news/immersive-story/2018/09/20/what-a-waste-an-updated-look-into-the-future-of-solid-waste-management

[2] Source: https://www.weforum.org/agenda/2017/12/germany-recycles-more-than-any-other-country/

Bridging the physical and digital world

A DIGITAL SHIFT

What is NFC technology?

NFC (Near Field Communication) is a wireless connectivity technology based on RFID (Radio Frequency Identification) enabling contactless communication between a reader and a tag.

A **tag** is a small electronic component which adds wireless connectivity to physical objects, such as consumer goods, clothes, pharmaceuticals and more. Moreover, it does not need a battery to operate.

On the other hand, there's the **reader** used to access a tag's content. The reader can be any **smartphone**, for example, with NFC capabilities.

2.5 billion*

of NFC-enabled smartphones in use as of 2020

This means that today a significant number of people around the world can interact with products, simply at a tap's length. In a nutshell, adding an NFC tag to an object connects it to the digital world.

Implementing NFC allows brands to track their products through their lifecycle, all around the world and to create a direct two-way communication channel with consumers via their smartphone, used as an NFC reader.

The technology has become mainstream in the past few years, fueled by contactless transactions and NFC-enabled smartphones.

How does it work?

The NFC tag embeds several advanced features including a unique identifier (UID) and a user memory, which allows a company to embed useful information for customers, such as a web link with product information or sustainability advice.

The user memory can be updated throughout the product's lifetime to reflect changes such as ownership.

For example, a website URL can be configured into the tag, and by simply "tapping" the NFC-enabled object with their smartphone (bringing the mobile phone and the tag in close proximity), end users can find out more about their product of interest. By opting for NFC, brands offer consumers a digital experience that helps them act more sustainably and ease recycling.

* Source : https://www.businesswire.com/news/home/20201028005744/en/Consumers-Embracing-the-Convenience-and-Security-of-NFC-Contactless-Technology

Technology for a more sustainable world

In addition to the traditional use cases enabled by NFC tags embedded in consumer goods, this technology also helps pave the way for responsible applications.

Here are several ways NFC technology can ease sustainability processes, towards a greener world.

- Consumer product sustainability information
- Second-life advice
- Responsible supply chain management
- Circularity
- Product eco-design
- Health and safety
- Consumer reward programs
- Product sustainability over lifecycle

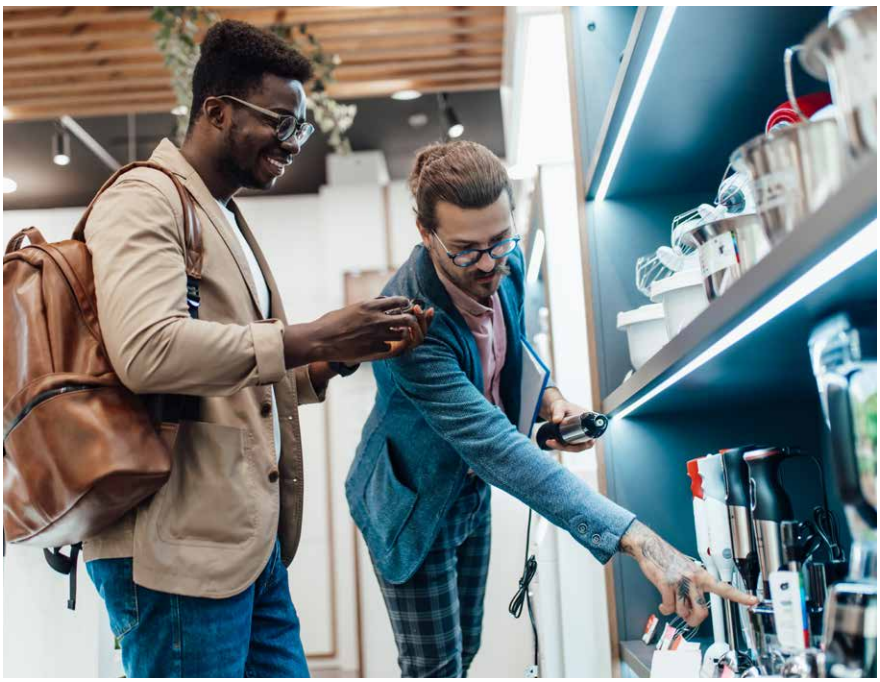
CONSUMER PRODUCT SUSTAINABILITY INFORMATION

At the pre-sale stage, consumers can be provided with key information on their product of interest that is displayed thanks to NFC tags embedded into products.

Description

Before buying a product in physical stores, consumers are often seeking information on products. They compare products from different brands in order to help make their choice. Sustainability comes more and more into consideration when it comes to choosing a product. However, due to size constraints, labels cannot include as much information as wanted.

By embedding NFC tags into products, brands and manufacturers can provide consumers with a wide range of information, including details in regards to sustainability.



How it works

By tapping the tag contained in the product with their smartphone, consumers can see what's in a product (for instance to find out if it contains hazardous substances) or know if the product is Fairtrade certified.

This helps them make informed decisions. NFC tags can therefore help empower consumers.

What NFC brings

• **Readability:** Thanks to its "Tap & Go" approach, users can read the tag content with just one tap. The native functionality of NFC tags, supported by Android and iOS, ensures a convenient user experience as you do not need to download or open an app to access the tag's content.

• **Continuity of service:** Thanks to data embedded in tags, product information can be accessed locally even if there is no network or Wi-Fi.

• **Rich content:** Certain NFC tags can embed up to 8 Kbytes of data, enabling brands to share a large amount of information, whether for end-consumers or for business purposes (asset tracking, ...).

SECOND-LIFE ADVICE

At the end of the product's lifecycle, tags can inform consumers on what they can do with their used products.

Description

When products reach the end of their lifecycle or when people no longer need them, may it be printers, pharmaceuticals or home appliances, consumers are offered several options on what to do next. But sometimes they are not aware of all the possibilities they have. Thanks to NFC tags embedded into products, users can receive this information to help them take the next step.

How it works

At the end of the product's lifecycle, consumers simply need to tap the tag contained into their product with their NFC smartphone to receive information on second-life options. They can find out if their goods are suitable for donations, the second-hand market, or for recycling.

To make recycling easier for all, users are provided with precise information and even with the nearest locations for sorting centers for instance. This is also particularly useful when it comes to devices where the tag can inform consumers about which parts or electronic components are recyclable and how to proceed. Regarding medications, people often do not know how to proceed and end up throwing them out, while solutions exist to collect them.

Examples of second life advice messaging
- Donation to medical centers
- Drop off at an approved recycling center

What NFC brings

- **Integration:** With their small form factor, NFC tags can be integrated into a wide range of consumer products, without affecting aethetics. Tags can also be embedded directly into electronic devices, ensuring that consumers can still access information even after discarding the secondary packaging.
- **Durability:** Thanks to their physical robustness, NFC tags have a long lifespan. Even after several years, people can still access data contained in the tags and find out how to recycle their product. This makes NFC tags particularly suitable for long-term use.

RESPONSIBLE SUPPLY CHAIN MANAGEMENT

Thanks to its Track & Trace functionality, NFC technology can help keep track of products and contribute to optimizing resources in order to avoid over-production or inventory issues.

Description

Inventory management is a strategic consideration of all businesses, especiallly since supply chains involve several players throughout the world, especially today when goods can be purchased physically instore or online.

Responsible supply chain management aims at helping companies improve their environmental performance along the supply chain, by reducing waste, emissions, and energy use.

By simply tapping the tags embedded in goods, companies can be provided with a wide range of data and therefore optimize supply chain processes.

How it works

Certain NFC tags (Type 5 NFC tags) are compatible with RFID infrastructure, thus contributing to linking all supply chain processes, from raw material to finished goods.

By using a compatible RFID infrastructure in their supply chain, companies can keep track of their goods in a more accurate way. This gives them more visibility over their supply chain. It consequently allows to avoid excess stock, as well as unnecessary transportation, and in the end, participates in optimizing resources. This can be particularly useful in the case of perishable goods, food, or medications for instance, where the supply chain optimization can help prevent food waste.

What NFC brings

• **Real-time information:** Being able to have real-time data is key to making quick and appropriate decisions when it comes to production. For instance, NFC can show retailers, or any other player, which products are or are not selling so they can make adjustments to avoid over-production or inventory issues. In the same way, if demand in one specific location has increased, the company can be notified rapidly and know when and how many items to ship.

• **Track & Trace and Unique Identifier (UID):** With an embedded track-and-trace function as well as a unique identifier (UID), NFC tags can geolocate goods and uniquely identify each product. By knowing which products are where, companies have more visibility over a product's lifecycle in an accurate, reliable, and efficient way.

CIRCULARITY

In additional to contributing to more optimized supply chains, the Track & Trace function can help keep track of products throughout their lifecycle, therefore enabling circularity.

Description

To improve sustainability, a circular economy aims to extend a product's lifetime for as long as possible and maintain its value through reuse, repair, donation, second-hand markets, and recycling instead of having them end up in the trash. Thanks to the Track & Trace function, NFC tags can contribute to circularity.

How it works

Embedding NFC tags can be particularly useful in the case of reusable containers so they can be tracked throughout their lifecycle. This type of application can apply to several situations, for instance restaurants offering takeout meals. In this use case, people can easily identify their order. When they pick up their food at the store or when it's delivered to their door, they simply tap the tag embedded in useable containers to send a delivery confirmation to the restaurant.

When consumers have their food in hand, they tap the tag embedded into the container to notify the reception. After use, consumers return the containers to the restaurant where they are tapped again to update the status. And then, containers are washed and put into the supply chain for new orders.

NFC tags can track items all along the workflow and provide an inventory in real time of the restaurant's resources for effective management while also enabling circularity.

What NFC brings

• **Recommissioning:** NFC tags have the ability to be reprogrammed and therefore repurposed. Using NFC / RFID readers, several tags can be identified and reprogrammed at the same time, offering companies with an efficient, cost-effective solution.

• **Privacy:** Tags such as ST25TV offer specific features, enabling device repurposing without compromising consumer privacy (GDPR compliance).

• **Sterilization (autoclave) and washing:** Reuse means washing containers before using them again. ST25 NFC tags offer a robust solution, from -40 to +85°C, which makes them resistant to washing. For even more durability, tags can be molded into the reusable containers and prevent them from direct exposure to external factors. For some products, sterilization is required and our NFC tags are resistant to autoclave sterilization.

PRODUCT ECO-DESIGN

Eco-designing products is a major challenge for consumer brands. Embedding NFC tags can help brands rethink their new product and packaging options by enabling refillable solutions.

Description

Today's packaging is becoming increasingly sophisticated, and often uses several different components and materials. This is particularly the case for perfume bottles, which have very specific design requirements. Bringing elaborated product design and sustainability together is not always easy for companies. This is where NFC tags may be useful, as they can be used to create products with an eco-design, for instance refillable goods such as perfume bottles, which can be refilled with cartridges.

How it works

Instead of having to buy a new perfume, consumers can now refill empty bottles rather than putting them in the trash.

With a sophisticated design, embedding an NFC tag lets manufacturers easily show consumers how to refill their product. By tapping the product with their NFC-enabled smartphones, consumers can access how-to guides or tutorial videos.

By providing users with product information, NFC tags play an educational role. They can indicate where cartridges are located, which is not always easy to guess, how to refill the product, and how to recycle. In the same way, consumers can directly reorder cartridges by tapping the tag.

NFC is an engaging technology, which allows a direct communication channel with brands. Simply said, it is a digital journey for consumers. This digital dimension opens up the way to sustainability and to refill schemes.

The path to sustainability does not happen in a day. Companies must go through several steps before achieving their goals. And NFC tags can help brands take sustainability to the next level.

Phantom by Paco Rabanne

Discover the story behind this NFC-enabled perfume bottle

What NFC brings

• **Non-line of sight:** unlike QR codes or barcodes, NFC tags do not need to be visible to be read (NFC tags can be read through plastics, liquid, wood, etc.).

• **Readability:** Thanks to its "Tap & Go" approach, users can read the tag content with just one tap. Users do not need to download or open an app to access the tag content, thanks to the native functionality of NFC tags, supported by Android and iOS, allowing a convenient user experience.

• **Integration:** With their small form factor, NFC tags can be integrated into a wide range of consumer products, without affecting aesthetics. Tags can also be embedded directly into electronic devices, ensuring that consumers can still access information even after discarding the secondary packaging.

HEALTH & SAFETY

By ensuring product authenticity and integrity, NFC tags are of great interest when it comes to contributing to people's safety.

Description

While sustainability is often defined as protecting the environment, ensuring people's safety is another key dimension. There are many factors that may potentially harm or have an adverse effect on people's health and safety. In the pharmaceutical industry, for instance, not respecting the correct dosage of a prescribed medication can adversely affect a patient's health. From a more general standpoint, counterfeit medications are a scourge with major health consequences. Fake goods affect all industries with serious consequences, especially pharmaceutical goods, wine and spirits, and baby formula.

Here too, NFC tags can help protect people in their daily lives, through several actions: informing people of product instructions and ensuring product authenticity and integrity.

How it works

Embedding NFC tags into medications can provide consumers with key information about the product and further ensure people's safety.

Dosage instructions : Very frequently people tend to lose or discard the packaging of their medications, as well as the instructions for use. This can be particularly problematic as patients no longer have access to key information: dosing instructions, side effects, etc.

Thanks to their small form factor, NFC tags can be easily integrated into a wide variety of packages including blister packs and bottles. By simply tapping the tag with their smartphone, people can display all relevant information to ensure their safety and well-being.

Expiry date warning

In the same way, people can be notified when the expiry dates of their medications come close or warn them in the case of an exceeded date. This prevents patients from taking out-of-date medicine that could affect their health, to a greater or lesser extent.

Anti-counterfeiting

NFC tags can also help guarantee product authentication. Indeed, using tags with a tamper detection feature can further ensure a product's integrity. By tapping the tag embedded in the medication box or bottle, both pharmaceutical companies and end-users can know if the product is authentic and has not been tampered with. This is especially useful in the pharmaceutical sector where fake drugs can have serious consequences.

Case study: Plastibell's connected syringe

NP Plastibell, an healthcare industry player, partnered with to create an innovative pre-filled syringe based on NFC technology.

NP Plastibell's pre-filled connected syringe

By over-molding an ultra-minaturized NFC tag directly into the syringe, patients and medical staff can validate its legitimacy, view the manufacturing history, see usage recommendations, and display other important information or warnings.

Patients can also easily set up reminders by scanning the tag with their smartphone.

By simply tapping the tag with their NFC-enabled smartphones, various stakeholders (manufacturing, medical personnel, and patients) can readily access important medicine-related information.

Read the full article to discover more about the connected syringe.

What NFC brings

• **Anti-counterfeiting:** The backbone of secure contactless payment and identification (passports), NFC technology enabled a high level of security that can protect consumers from potentially harmful counterfeit goods.

• **Tamper detection:** NFC tags are also available with additional protection features including tamper detection functions that further contribute to ensuring the product's integrity.

• **Consumer privacy:** Tags such as our ST25TV Type 5 NFC tags offer specific features that make it possible to repurpose devices without compromising consumers' data privacy rights (GDPR compliance).

• **Integration:** With their small form factor, NFC tags can be integrated into a wide range of consumer products, without affecting aesthetics. Tags can also be embedded directly into electronic devices, ensuring that consumers can still access information even after discarding the secondary packaging.

CONSUMER REWARD PROGRAMS

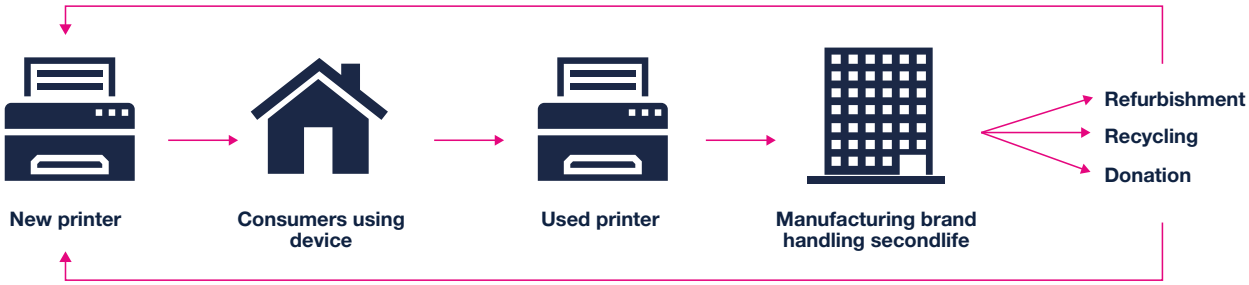
By embedding NFC tags in goods, consumers can keep track of their sustainable actions and be rewarded accordingly, through credits or other incentive schemes.

Description

One way to have people become more involved in sustainable initiatives is to reward them for their efforts. Each time consumers take an action toward recyclability, such as returning devices to the manufacturer or other organizations, they are given credits or rewards in return. NFC tags embedded in products make it possible to track goods throughout their lifecycle, from manufacturing to end of life. Brands can therefore offer more transparency to their customers about the product's lifecycle (repurposing, second-hand markets, etc.).

How it works

For high-value products and devices, brands and organizations can use NFC technology to create reward programs to encourage sustainability. Brands can roll out services where consumers send back their used devices. When brands receive the devices, they tap the embedded tag and consumers automatically receive rewards or coupons. Brands can then decide on what to do with the devices: reconditioning, recycling or donation. As brands or organizations have existing infrastructures, handling the second-life of the products is easier.



Main steps for a circular economy

What NFC brings

• **Integration:** the NFC tag's small form factor allows it to be integrated into a wide range of consumer products, without affecting the product's aesthetics. Tags can also be embedded directly into electronic devices. Consequently, consumers can still access information even after getting rid of the secondary packaging.

• **Durability:** Thanks to their physical robustness, NFC tags have a long lifespan. Even after several years, people can still access data contained in the tags and find information on how to recycle their product. This makes NFC tags particularly suitable for long-term use for a more sustainable level of consumption.

• **Track & Trace and Unique Identifier (UID):** With an embedded track-and-trace function as well as a unique identifier (UID), NFC tags can geolocate goods and uniquely identify each product. By knowing which products are where, companies have more visibility over a product's lifecycle in an accurate, reliable, and efficient way.

• **Recommissioning:** NFC tags have the ability to be reprogrammed and therefore repurposed. Using NFC / RFID readers, several tags can be identified and reprogrammed at the same time, offering companies an efficient, cost-effective solution.

PRODUCT SUSTAINABILITY OVER LIFECYCLE

Manufacturing: At the beginning of the product's lifecycle, the tag is programmed with various information, such as the product composition, traceability data and recycling information.

In-store: Before purchasing a product, and while in-store, consumers can access data stored at the manufacturing stage and find out more about the product's composition, environmental ratings, consumer labels, and more.

At home: After purchase, consumers can tap the tag with their smartphones to access other NFC functions. For example, they can register the product in their name, activate the warranty, or learn about recycling and find the nearest collection locations.

Second-life: when used goods have been collected and are ready to be recycled, the recycling plant equipped with NFC readers can count and track each item.

What NFC brings

• **From factory to consumer:** NFC tags uniquely enable several use cases in a single tap. Brands may want to provide consumers with product information, as well as ensure the authenticity of the product, and reward them with coupons when they return used goods. One single tag can therefore be useful throughout the product's entire lifecycle.

A WIDE AND UNIQUE RANGE OF POSSIBILITIES...

NFC technology

Integration

Does not affect product aesthetics

Durability

Long lasting thanks to physical robustness

Track & Trace and UID

Geolocation and unique identification of goods

Recommissioning

Possible repurposing and reprogramming

Real-time information

Anti-counterfeiting

Highly secure solution protects consumers from potentially harmful fake goods

Consumer privacy

GDPR compliance

Non-line of sight

Tags can be read even if not visible

Product sustainability over lifecycle

Sterilization & washing resistant

Temperature operating range from -40° to +85°C and autoclave resistant

Tamper detection

Physical protection ensuring product integrity

... BRINGING BRANDS AND CONSUMERS TOGETHER FOR A MORE SUSTAINABLE WORLD

Consumers

Learn

- Product traceability information
- Product recycling instructions
- Product composition

Act

Facilitates recycling and second-life processes through guidance and support

- How-to guides
- Nearest locations for collecting or recycling goods

Reward

Receive rewards or credits to encourage efforts

Brand & Consumers working together

- **Engagement:** create a direct digital relationship between brands and consumers
- **Changing behaviors:** stakeholders can benefit from one another: consumers with guidance and rewards, and brands with consumers' insights; both acting toward sustainability
- **Enabling circularity:** thanks to the joint efforts from both brands and their customers, products are no longer included in a linear pattern, but in a circular one

Brands

Inform

Inform consumers about environmental regulations along with the product's ESG score and energy label

Engage

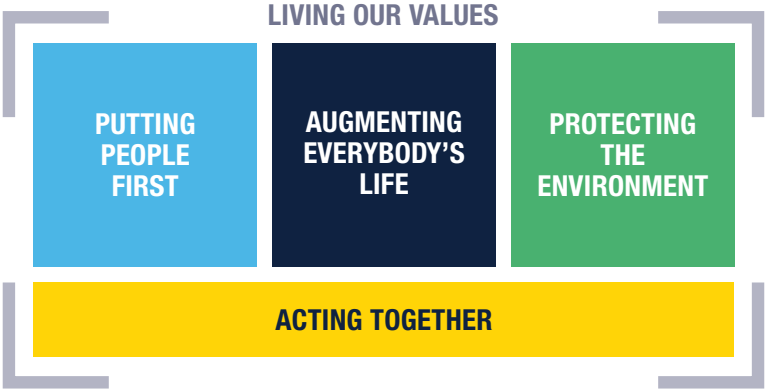
Learn valuable insights about consumers behavior: how often people interact with the product, require refills, etc.

Improve

Better understand the product's environmental footprint: gain visibility on the product's impact on the environment throughout its lifecycle

ST's commitment to sustainability

A world leader in providing semiconductor solutions that make a positive contribution to people's lives, STMicroelectronics plays a major role in paving the way for a more sustainable world.



ST's commitment to sustainability is part of our DNA for more than 25 years and defines our environmental mission:

> To eliminate or minimize the impact of our processes and products on the environment, maximizing the use of recyclable or reusable materials and adopting, as far as possible, renewable sources of energy, striving for sustainable development.

Today our comprehensive roadmap to carbon neutrality includes compliance with the 1.5°C scenario defined by the Paris Agreement, which implies a 50% reduction of direct and indirect emissions by 2025 compared to 2018 and the sourcing of 100% renewable energy by 2027.

ST's commitment gets stronger every day and we intend to continue our efforts for a greener future for the next generations.

SUSTAINABILITY

We create technology for a sustainable world,
We prioritize people and the planet,
We generate long-term value for all stakeholders.

www.st.com/sustainability

life.augmented

SUSTAINABILITY CHARTER

Discover ST's commitments and long-term goals for sustainable development.
Download our **charter**

ST25 NFC solutions for sustainability

A complete portfolio for a wide range of applications

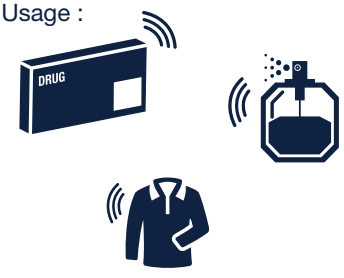
One of the early pioneers of RFID and NFC technologies, ST offers a comprehensive range of products, including the ST25 product family.

This NFC-based product family provides customers with a complete portfolio of NFC and RFID tag and reader ICs for a wide variety of NFC-enabled solutions.

ST25T NFC / RFID tags

NFC tags can be integrated into any type of goods in order to allow interactions between consumers and the product. Battery-less, they are particularly suitable for sustainable applications.

Usage :



ST25D Dynamic NFC tags

Able to communicate with environmental and motion sensors, dynamic NFC tags offer advanced solutions for connecting goods with a base-unit, while keeping the battery-less capability.

Usage :

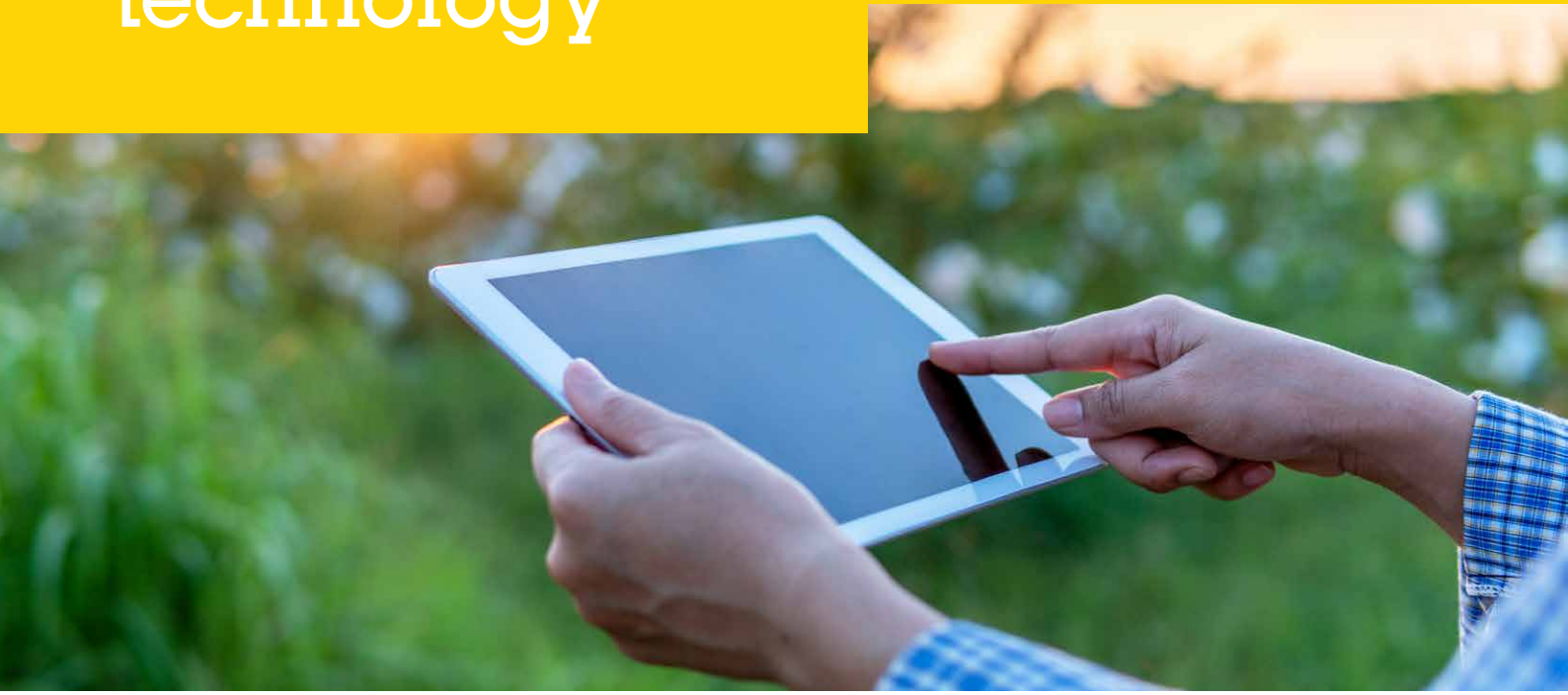
ST25R NFC / RFID readers

Designed to collect data from tags, NFC readers are particularly suitable for supply chain management applications, as they can scan multiple items at the same time.

Usage :

Please note that while tags and dynamic tags are integrated into goods, reader chips are used as a main unit (embedded in industrial readers for instance) to read information contained in the tags. Readers can be equipped with advanced features that can handle item tracking and ensure a good level of security.

Delivering a sustainable technology



In ST, we create products for a sustainable world, in a sustainable way.

ST CERTIFICATIONS

ST manufacturing sites have received the following ISO certifications related to environment, health and safety (EHS) and environmental and social governance (ESG) programs:

- **ISO 14001** specifies the framework for an Environment Management System (EMS) that minimizes environmental impact while meeting regulatory requirements.

- **ISO 50001** is an Energy Management standard for helping organizations reduce their environmental impact, conserve resources and improve the bottom line through efficient energy management.

- **ISO 14064** provides a complementary set of tools for programs to quantify, monitor, report and verify greenhouse gas emissions.

- **ISO 45001** specifies the framework for an Occupational Health and Safety Management System (OHSMS) standard to help organizations improve employee safety, reduce workplace risks and create safer working conditions.

For more information, visit the **International Organization for Standardization webpage.**

PRODUCT CERTIFICATIONS

As part of our sustainable approach, all ST25 NFC products are:

- Compliant with the **RoHS directive** (Restriction on the use of certain Hazardous Substances)
- Compliant with the **REACH** regulation (European Regulation on Registration, Evaluation, Authorization and Restriction of Chemicals)
- **Conflict-free minerals**

"Conflict minerals" refers to minerals that are mined, traded, controlled, supported or financed by illegal armed groups, causing serious human rights violations and environmental damage in the region of conflict.

Member of the Responsible Minerals Initiative (RMI), ST has achieved 100% conformance with the Responsible Mineral Assurance Process (RMAP) standard. This means that all products, including ST25 NFC products, are certified conflict-free.

Material Declaration Form

An exhaustive list of substances is also made available for ST products, thereby informing customers and guaranteeing to them that the product complies with environmental legislation. It can be found on st.com, on each product page.

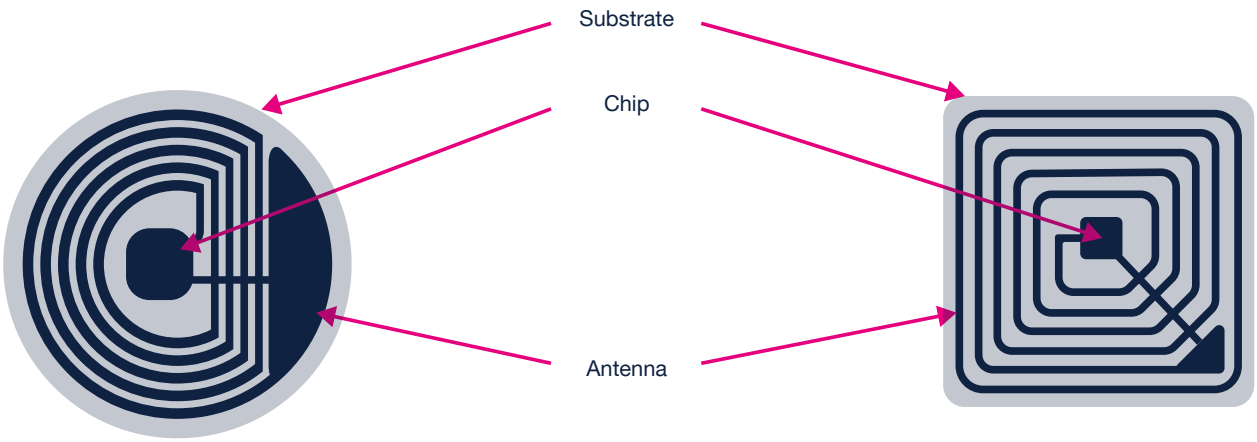
Sustainable Technology Label by ST

In addition, and always in the sustainable approach undertaken by ST, the company has developed the Sustainable Technology program and label. This label is given to devices that have followed an eco-design approach, which reduces their ecological footprint in compliance with environmental legislation and ensures they enable innovative environmental and social applications.

Check out which ST25 NFC products are part of the program here.

Taking a step further into sustainability

Beyond enabling sustainable solutions, the NFC tag's environmental impact can be reduced by improving efforts at each step.



An NFC tag is composed of three main components:

- **The NFC chip** (provided by ST): is a tiny electronic component handling RF communication and storing the tag data
- **The antenna:** allows the communication between the reader and the tag by transmitting and receiving radio waves
- **The substrate:** it holds the chip and the antenna together

INDUSTRY IMPROVEMENTS AT EACH STEP

Having in mind to make things change regarding sustainability, the industry also made progress recently for each component.

Thanks to increasingly optimized manufacturing processes, the die size of a chip has been reduced to 0.5 mm^2, decreasing the number of total wafers needed for a given number of tags. In terms of thickness, new generations of tag ICs are progressively becoming thinner with 120µm technologies today, and 75µm and less tomorrow.

Moreover, companies are also improving how they manufacture antennas. New processes reduce the use of harmful chemicals as well as optimize the quantity of metal used. It is also important to note that most antennas today no longer contain heavy metals.

Finally, for the substrate, several companies have developed innovative, environmental-conscious substrate solutions, among which the most common one is the paper-based substrate, and we can even find wood-based substrates. These solutions are called “eco-friendly tags”.

AN ECOSYSTEM OF SUSTAINABLE PARTNERS

The NFC ecosystem is composed of companies that are committed to the environment.

Most players are compliant with the ISO 14001 regulation, as well as directives that regulate the use of chemicals and hazardous substances (RoHS and REACH directives within the European Union).

Furthermore, certain companies using paper-based substrates are certified by the Forest Stewardship Council (FSC) standard, which ensures sustainable forest management.

Want to jump in?

ST25 Connect

To support companies looking to implement NFC technology, we created the ST25Connect program

ST25CONNECT, HELPING BRANDS IMPLEMENT NFC TECHNOLOGY

ST25Connect is a program that aims to ensure the best product integration and implementation of NFC technologies.

By supporting companies from a wide range of industries in the NFC implementation process from start to finish, we enable the success of their NFC projects.

Why this program?

In practice, the successful integration of NFC technology in consumer products involves multiples stakeholders and requires technical expertise, time, and resources, especially if you are new to NFC technology.

The ST25Connect program is a service provided by ST to ensure the best product integration and implementation of NFC technologies.

With the ST25Connect program, you can benefit from ST's technological expertise and our network of trusted partners. In direct contact with ST's experts, you will be provided with personalized advice and the NFC technology you need to grow your business.

For more information on how ST can help you get started, please contact us:
st25connect@st.com

or visit our website:
st.com/st25connect

ADDITIONAL RESOURCES

ST25 NFC portfolio [Portfolio overview]

ST25T tags [Product overview]

ST25 Evaluation tools [Portfolio overview]

NFC design considerations for an improved User Experience [Whitepaper]

ST25Connect program [Landing page]

Sustainability [Landing page]

Sustainable Technology Products [Product overview]

Note: ST25Connect™ is a registered and/or unregistered trademark of STMicroelectronics International NV or its affiliates in the EU and/or elsewhere.

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