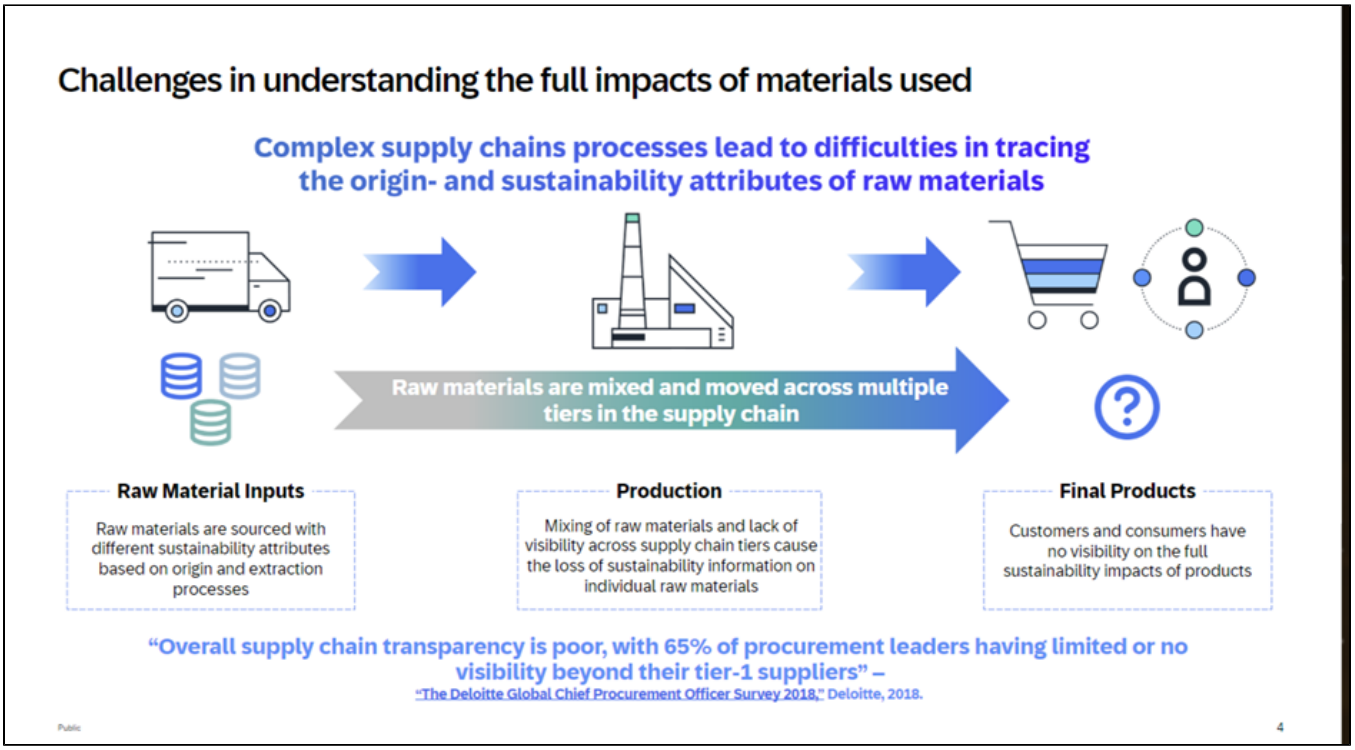
KDD064 - Mass Balance and Sustainability Material Tracing

Status	Approved
Owner	Stefanie Schwartz
Stakeholders	Marie Flourie

Issue

Currently, there is no process or tool (structured or streamlined) to measure sustainable raw material percentages through the supply chain processes in Syensqo. The company only has limited visibility into the origin of materials and to which extent they are truly sustainable. Syensqo will have to disclose zero percentages as part of reporting as Syensqo is unable provide evidence with regards to actual percentages. It carries a considerable reputational risk for Syensqo, which could also turn into a financial risk as green investors only consider Green Bond financing opportunities. Green bonds are fixed-income financial instruments which are used to fund projects that have positive environmental and/or climate benefits. Green bonds issuers may rely on percentages of sustainable raw materials among other elements. Mass balance is used for commercial advantage and requires solid solution going forward.



In contrast, Syensqo is making claims to customers about the sustainability of some of their products. It is contradictory to the annual company reporting stating low percentages of sustainable or renewable raw materials. Syensqo needs a solution to enable the company to disclose sustainable raw material percentages based on actuals to customers in line with CSRD requirements going forward to alleviate further reputational and financial risks.

Further, there is the need to capture and record various sustainability attributes attached to raw materials and track them end to end in order to be able able to issue certificates or KPIs at the finished product level, as per regulatory or customer requirements.

Recommendation

The recommendation is to implement Material Traceability via Option D using Production BOMs for certified materials. The solution enables an improved level of traceability and transparency from source to end product whilst managing supply chain complexities. Further, it allows the company to track and report GHG emissions of products that are received and sold in conformance with certification standards as well as other Sustainability attributes.

The implementation of an appropriate Mass Balancing solution across the production processes still allows Syensqo to look at additional requirements e.g. around blockchain in the future.

Background & Context

Supply chain sustainability is based on the traceability and transparency of sustainable material usage for commingled and bulk-traded materials. Ther e is a regulatory drive by the Corporate Sustainability and Reporting Directive (CSRD) to disclose percentages of sustainable raw materials as part of a s part of resource inflows reporting (Scope 3) . It is relevant for non-bio-sourced (e.g. fossil-based plastics to circular plastics) and bio-sourced (e.g. vegetable or animal origins and biodiversity) raw materials as well as recycled materials.

Today the information relating to raw material percentages is collected and stored in a redundant, unstructured and non-auditable manner, which is reflected in the current process. The inconsistency reflects the disconnect between Marketing and the regulatory requirements.

1. Initially the customer requests a non-GMO certificate.
2. Questions arrive at the frontline desk.
3. Questions are then forwarded to the Sustainability champion of the relevant GBU.
4. The Sustainability champion then asks the buyer to send a form to the supplier. Data needed from supplier is GBU specific e.g. Aroma and food.
5. Alternatively the Sustainability champion contacts Product Stewardship.
6. The completed forms are finally stored on a personal Google drive.

There is an argument that 100% of raw materials in scope for this solution because Syensqo must report on a % of biobased materials out of the total quantity of purchased raw materials. Syensqo needs to secure the traceability of special cases as well as the total. A dry run exercise that is currently being run by Sysensqo should confirm percentages by end of September 2024. Whilst the percentages of biobased materials will be smaller, the total set of materials in scope of this is 100% hence supporting the recommendation of a technology focused solution.

Currently with regards to the financial valuation of inventories, the normal RM and the certified RM have two different values (two different purchasing prices). Once put together (after the virtual process order) the resulting value of the stock will be a weighted average.

It needs to be considered that one of the IFRS rules is that Syensqo's physical stock on hand should be aligned with what exists in the system (physical versus available stock).

The following Sustainability attributes are examples of what needs to be considered as part of the future solution:

- GHG emissions
- Genetically Modified Ingredients (GMO).
- Aroma related certificates relating to halal, kosher, vegan.
- EU deforestation and sustainability of forests, relevant for Novecare where customers are requesting natural rather than chemical ingredients.

Audits

At company level, Syensqo has KPIs on circular sales hence asking each GBU for sales of renewable products twice per year. There is a lack of transparency as part procurement process resulting in Syensqo having to change as auditors will not accept current way of working. Circular sales KPIs have been audited for four years by Deloitte. Since last year these KPIs have been audited by Ernst and Young, which nearly failed in first year. If audit fails next year then the figures cannot be published in the annual report. Sysensqo's credit rating as well as credibility might be impacted.

It holds a different level of risk at product level, where products could be sold at higher price due to being sustainable e.g. the purchase of palm oil which is certified sustainable. Audits are possible from customers at random and fines and commercial disputes are possible due to breach of contract.

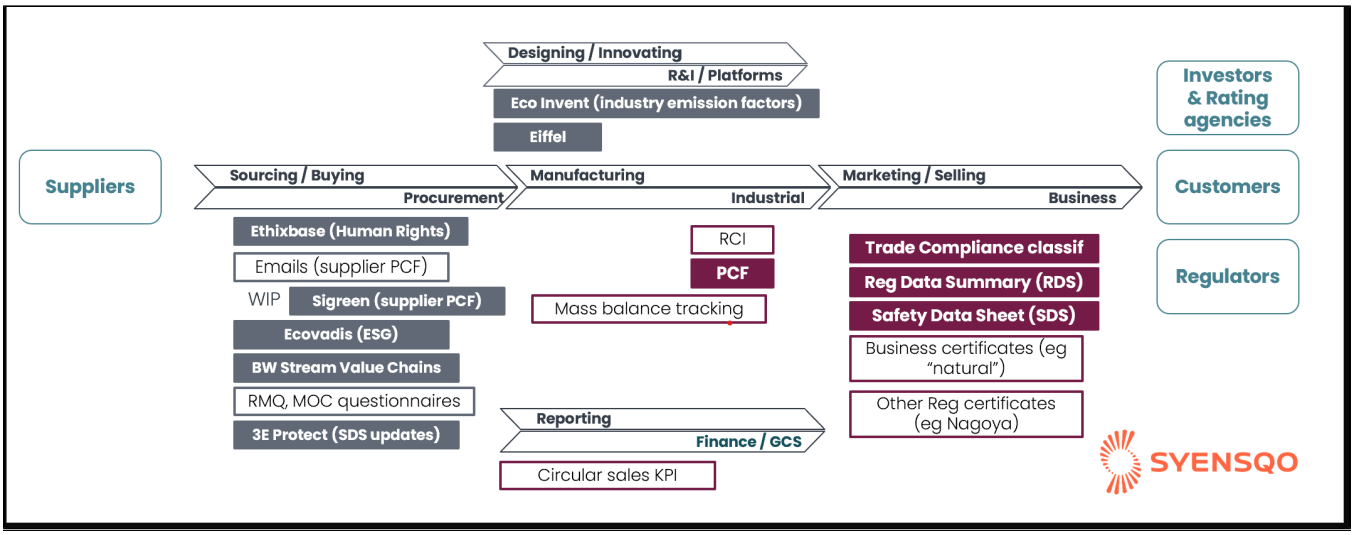
Certification

The mass balance approach is an important milestone on the pathway to a circular economy and bioeconomy. It has been designed to trace the flow of materials through a complex value chain. The mass balance approach is used among other in ISCC Pl us certification . ISCC Plus is a voluntary sustainability certification for e.g. plastics and chemicals to reflect that traceability along the supply chain is given.

Conforms to EUDR (EU Deforestation-free Products Regulation). Introduced in 2023 and was planned to be mandatory from December 2024. A proposal for a one year postponement was issued in September. (https://ec.europa.eu/commission/presscorner/detail/en/ip_24_5009). EUDR carries fines for non-compliance of up to 4% of annual EU revenue)

Current Landscape

No impact on current Sustainability landscape as currently managed using Excel files only.



SAP GreenToken

SAP Green Token is a chain-of-custody business application designed to help organizations trace and account for certified sustainable versus conventional products throughout the supply chain network. Organisations can trace the inbound material's origins from their suppliers and outbound product sold to downstream partners. It is a SaaS (Software-as-a-service) cloud stand-alone solution. SAP GreenToken has been previously investigated by Syensqo in 2023 when it was decided to await the implementation of SAP S/4HANA. It has been implemented as a solution for other companies in the extended chemicals industry e.g. Eastman Chemical and DIC Corporation.

The solution capabilities include the following:

- Mass balance accounting
- Traceability and transparency of attributes
- Managing supply chain complexity
- Accessibility and onboarding
- Certification management
- Reporting and auditing
- Data privacy and process transparency
- Automation via integration:
    - Open APIs for non-SAP systems.
    - Integration with SAP sustainability solutions e.g. SAP Product Footprint Management (PFM).

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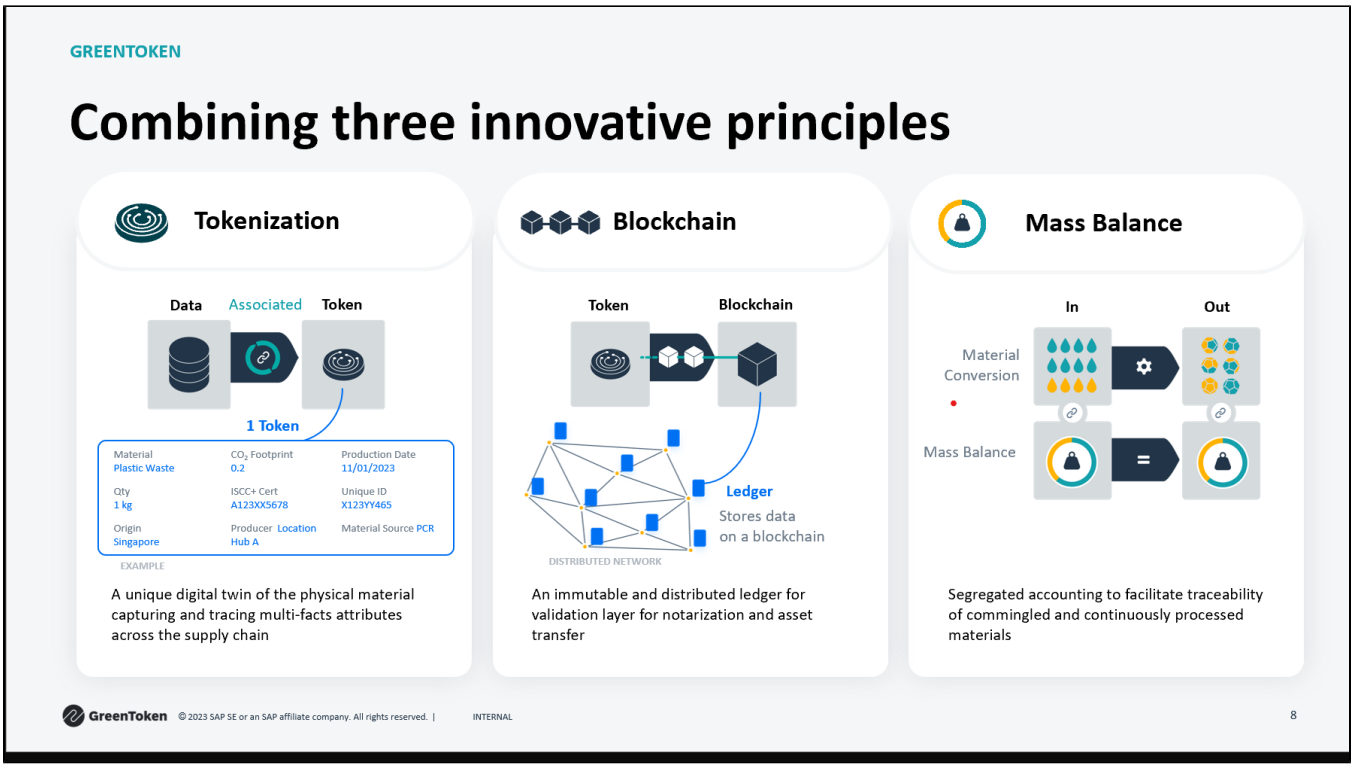
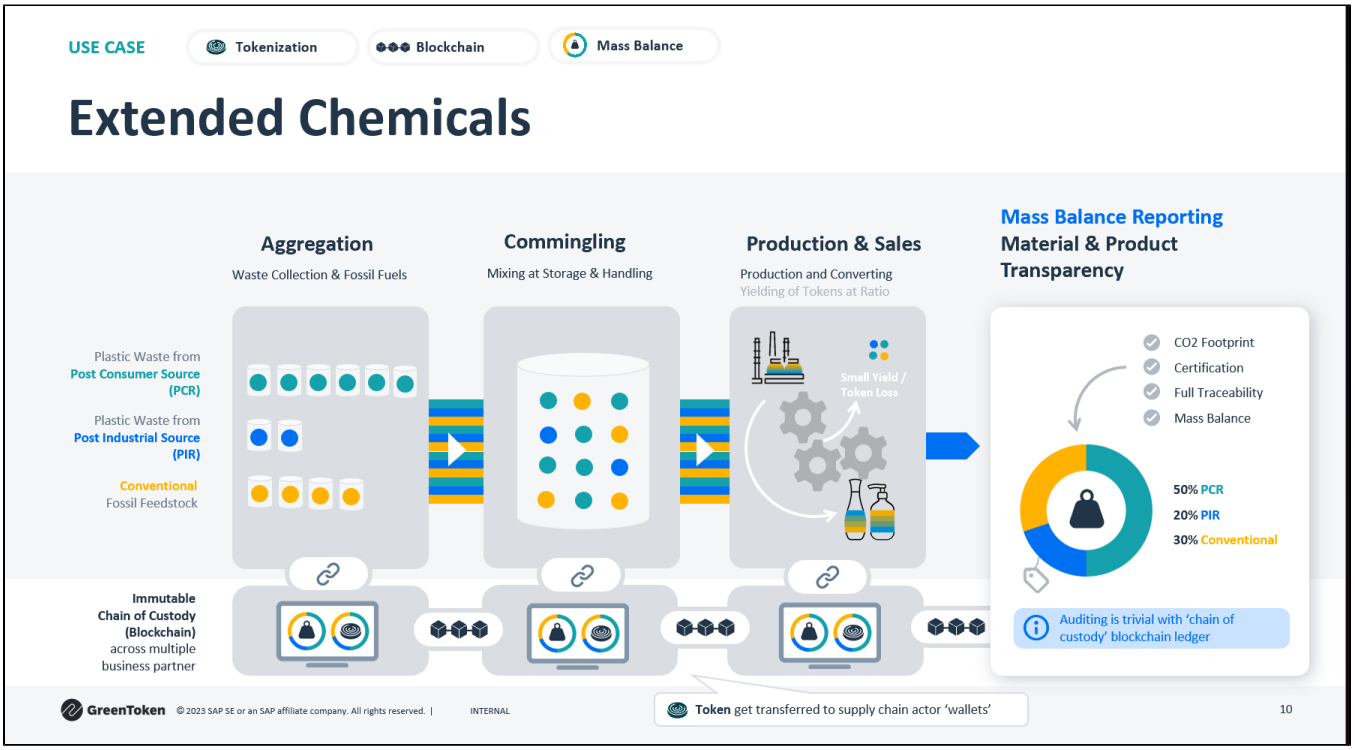
Using the principles of mass balance, tokenization and blockchain, SAP Green Token acts as a multicommodity platform that enables the accounting of the full chain-of-custody of commingled raw materials to their origin. By combining Tokenization, Blockchain and Mass Balance the solution supports certification management for e.g. ISCC+.



Use Case Example:



Track and Trace

The chain of custody feature provides transparency into all materials as per inventory and what materials they are comprised of. It also provides key information on the materials, the number of sustainable and conventional volumes transferred, along with the identity of the member who provided the material. This level of transparency is only available for upstream members of the network. The supply chain member accessing chain of custody won't have this level of transparency for downstream members of the network.

The material provenance view shows the original raw material from which the selected product or material was derived, regardless of the intermediary conversions or transformations. It gives visibility of the sustainable qualities of raw material from its original source and introduction into the supply chain.

Data can be sourced from:

- IoT Devices and Sensors: Real-time data from IoT devices and sensors installed at different stages of the supply chain.
- Enterprise Resource Planning (ERP) Systems: Integration with ERP systems like SAP ERP to pull relevant data.
- Manual Entry: In cases where automated data collection is not possible, manual data entry can be performed by authorized personnel.
- Third-Party Data Providers: Data from third-party providers who specialize in sustainability metrics and certifications.

Data can be input into SAP GreenToken through various methods:

- APIs (Application Programming Interfaces): APIs allow for seamless integration with other systems, enabling automatic data transfer.
- Batch Uploads: Bulk data can be uploaded using CSV or Excel files, especially useful for historical data or large datasets. Uploading CSV files automatically drives other features within SAP Green Token, such as volume requests and the creation of volumes, and creating or updating entries on the inbound delivery screen.
    - Inbound Deliveries CSV
    - Conversions CSV
    - Pending Orders Fulfilment CSV
    - Goods Issued CSV
    - Sales Inquiries CSV
- Mobile and Web Applications: User-friendly interfaces for manual data entry and real-time updates.
- Blockchain Integration: Data can be directly recorded on the blockchain, ensuring immutability and transparency.

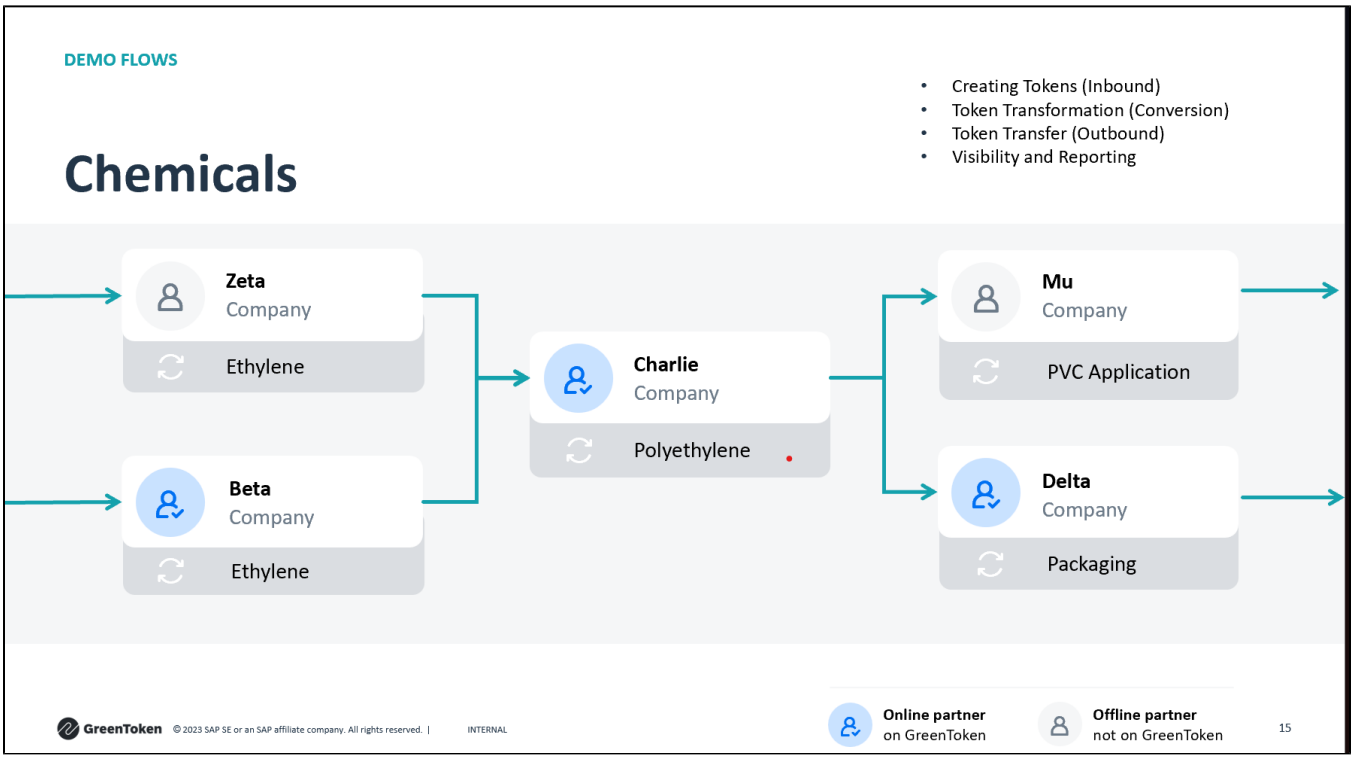
Sustainable and conventional (non-sustainable) commodities are traced through your supply chain and production processes using mass digital twins (tokens) on a blockchain. This allows transparency from different origins to be measured by counting the tokens. Each organization or member of the supply chain forms part of the network. Members of your supply chain network that are onboarded into SAP Green Token are referred to as 'online' members, while those that are not are 'offline' members. There are slightly different workflows for interacting with online and offline members.

Process workflows include:

- Conversion Workflow
- Outbound Workflow
- Inbound Workflow
- Consumption Workflow
- Multisite Workflow

Example for online partner inbound workflow:

1. Consolidate relevant deliveries for the delivery period: automated upon integration with SAP S/4HANA.
2. Extract delivery information to Inbound Deliveries CSV: extract the inbound deliveries identified and consolidated in the step above and populate the Inbound Deliveries CSV manually or automatically if configured appropriately in the ERP system.
3. Import the CSV into SAP Green Token: entries on the Inbounds screen are created by uploading volumes in CSV files using the Import CSV b utton on the overview screen or by dragging and dropping files on the Imports screen. After uploading an inbound deliveries CSV, you can review all inbound delivery transactions on the Inbounds screen. The Inbounds screen provides details on the delivery of certified and conventional materials. Users can view different attributes associated with the materials as well as the status of the order.
4. Fulfilment request generated and inbound delivery entries created.
5. Request fulfilled by upstream partner.
6. Tokens received and your balance is updated.



Certification and Reports

Green Token allows the company to track and report GHG emissions of products that are received and sold in conformance with ISCC+ standards. It is accomplished by the persistence of attributes to the certified tokens associated to an inbound and conversion order. ISCC GHG attributes are provided out-of-the-box with Green Token. The attributes can be assigned to any material to track and report against manufacturing and delivery processes.

The Reports view includes a set of complementary reports which can be used to support audits for International Sustainability and Carbon Certification (ISCC). The data for these reports is generated in real time through the day-to-day transactions that are executed in SAP Green Token. It reduces the level of effort and the margin for error in pulling supporting details from disparate systems. The following reports are available:

- Conversion Audit Report
- Material Balance Report
- Material Movement Audit Report
- Order Audit Report
- Transaction Audit Report

Assumptions

- There is a current RFI to replace Ethixbase for use case 1 (company information), which is not in scope for ERP as there is an immediate need for implementation due to the termination of Ethixbase in December 2024. Use case 2 (product level information), for which there is no time constraint, is covered by the ERP Rebuild project based on this Key Design Decision Document.
- This KDD becomes redundant if the SAP Sustainability Footprint Management solution covers the requirements for material traceability.
- GreenToken cites end to end views, which is more beneficial if suppliers participate and provide data via SAP GreenToken.

Constraints

SAP Roadmap for GreenToken:

- Due diligence statement management for the Regulation on Deforestation Free Products (EUDR)
- Configure, manage, and apply EUDR and deforestation free–related information across transactions (Q3 2024)
- Automatically submit, retrieve, and manage information from external EUDR systems

Impacts

- The sustainability data from SAP GreenToken is integrated into SAP SFM through APIs or middleware that facilitate the transfer of data between the two systems.
- There is an impact on integrated supply chain processes (inbound and outbound) e.g. procurement and manufacturing.
    - Every raw material in question must be batch managed, which is possible by managing the batch mix where multiple deliveries arrive in one tank.
    - An assessment will be required to understand the impact on the logistics and supply chain teams for materials which are currently not batch managed today.
- The relevant master data requires support and governance. For example, it is implied that the vendor or Syensqo have a responsibility to capture some metadata.

    - Required attributes in case of electronic vendor communication (e.g. ASN) to be included in electronic communication channels.
    - Required attributes in case of manual vendor communication to be entered at point of receipt by the warehouse personnel based on paperwork from the vendor.
- Potential integration impacts with Ariba (if any) are to be confirmed.
- Segregation capability to identify which raw materials are being consumed in which process may require changes in production.
- There is an argument that 100% of raw materials in scope because Syensqo must report on a % of biobased materials out of the total quantity of purchased raw materials. Syensqo needs to secure the traceability of special cases as well as the total. A dry run exercise that is being run by Sysensqo at the moment should confirm percentages by end of September 2024. Whilst the percentages of biobased materials will be smaller, the total set of materials in scope of this is 100% hence supporting the recommendation of a technology focused solution.
- There might be a financial impact in capital expenditure (CAPEX) to allow the implementation of the process e.g.:
    - Deployment of IT solutions to capture the metadata from the vendors
    - Technology improvements e.g. mobility solutions for the warehouse e.g. scanners to collect or enter specific information
    - Potential requirement to use more tanks to store the products from the vendors independently.
- Key impact for GBU Specialty Polymers, which have close to 100m€ of sales based on Mass Balance and growing.

Business Rules

The solution is relevant for product level information for non-bio-sourced and bio-sourced raw materials.

Options considered

Option A: SAP Green Token

- Ensures traceability as part of Procurement (Sourcing/Buying)
- Substantiates sustainability claims to derive value based pricing (Marketing/Selling)
- Reduces Scope 3 emissions as part of Supply Chain (Transporting)
- Follows trajectories to meet targets as part of Reporting (Finance/Regulatory)
- Supports access to green financing
- Meets ESG expectations (customers/regulators/investors/disclosure)
- Identification of raw materials consumed in which production process is possible with with different materials code (preferable) or with batch management and classification.
- Requires batch management of all raw materials including an assessment to understand the impact on the logistics and supply chain for materials which are currently not batch managed.
- Master data governance e.g. responsibility of vendor or Syensqo to capture some metadata.

    - Required attributes in case of electronic vendor communication (e.g. ASN) to be included in electronic communication channels.
    - Required attributes in case of manual vendor communication to be entered at point of receipt by the warehouse personnel based on paperwork from the vendor.
- Potential financial impact in capital expenditure (CAPEX) to allow the implementation of the process e.g.:
    - Deployment of IT solutions to capture the metadata from the vendors
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    - Potential requirement to use more tanks to store the products from the vendors independently.

Option B: Hentrac

- Small start up company founded in 2022.
- Niche alternative.
- Specialises in supply chain traceability.
- All batches are identified throughout the entire production and distribution process by setting up parallel or sequential production processes.
- E2E mass traceability solution using a designated platform.
- Combines production data with sustainability information, which is exportable.
- Notifications of breaches.
- Very small use case, only ISCC plus audit.
- Demo scheduled for Syensqo in September 2024.

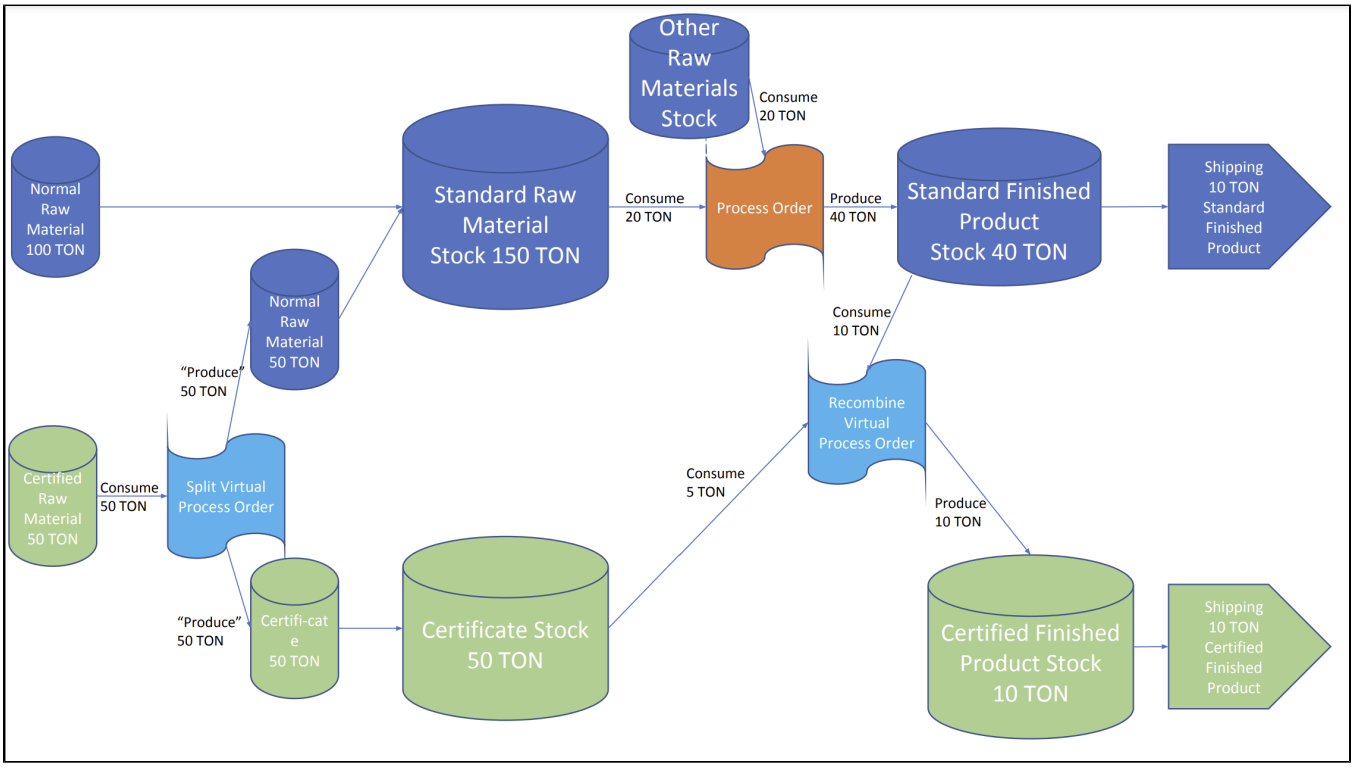
Option C: Do Nothing

- No product life cycle management.
- Continued use of Excel files.
- No ERP integration.

- No central data repository.
- Issues as described would remain

Option D: Mass Balance using Production Order BOMs

Custom solution using SAP standard functionality for mass balancing via the use of production orders (virtual process orders), which decompose the certified raw materials after goods receipt and to compose the certified finished product before shipping. The solution guarantees the proportions of certified/uncertified finished products the business sells are compatible with the quantity of certificates received. It allows demand management of certified and non-certified products. Material traceability is covered via standard segregation of material codes together with batch traceability.



Material Management:

- Management of certified and uncertified raw materials as different material codes. Every sustainable raw material requires a certified material. Certified finished goods have separate material codes.
- Traceability of certifiable material usage via goods movements and stock of certificates.
- Different material masters upon purchase, then use consumption of certified into normal material via purchase order.

BOM Management:

- Use of BOMs where the uncertified raw material is composed by the certified materials and generates the certificate as co-product (additional material).
- BOM is composed by the uncertified finished goods and the proportional quantity of the certificate.
- BOM acts as link between purchasing and selling purchased or produced raw material.
- Expiry dates of certificates is reflected as shelf life.
- There may still be the requirement to batch manage receipt of received materials.
- BOM conversion immediately upon goods receipt. Certificates stay with BOM until consumed by finished product.
- It requires the creation and confirmation of process orders. Process order check is possible if certificate consumption was not made.
- One or more process order can use up the remaining certified stock as needed until empty.
- Multiple certified stocks could be used on one process order.
- One certificate per raw material number meaning each certified raw material will have a unique certificate.

Average Value:

- Normal RM vs certified RM never come together. Example:
    1. Normal RM is received in stock at his own value, e.g. 2 EUR / Kg
    2. Certified RM is received in stock at his own value, e.g. 3 EUR / Kg
    3. The split process order consumes the certified RM and puts in stock the normal RM (2 EUR / Kg) and the certificate (1 EUR /Kg)
        a. The stock of the certificate is not physical stock: it represents the amount of certificates you own based on the certified RM you purchased.

4. Production Runs:
    a. Syensqo produces a finished product, the normal not certified stock has for instance a value of 10 EUR /kg and it uses 30% of the Raw Material.
    b. The finished product is sold as "normal": the COGS is 10 EUR / Kg
    c. The finished product as "certified": immediately before shipping the process order is created and confirmed to recombine the product with the certificate. The process order:
        i. Consumes the normal FP,
        ii. Consumes a quantity of the certificate equal to 30% of the finished product (BOM proportion of the Raw Material).
        iii. Confirmation books the GR of the certified FP whose value is 10,30 EUR / KG.
        iv. Is sold at this COGS.

Evaluation

	Option A - SAP GreenToken	**Option B - Hentrac**	**Option C - Do Nothing**	**Option D - Mass Balance via BOMs**
Compliance	⊕ Support continuous compliance with evolving standards and regulations. ⊕ Meets ESG expectations (customers/regulators/investors/disclosure) ⊕ Enables proof of certified commodity chain-of-custody and ownership whether it be inbound, processed, or outbound. ⊕ Substantiates sustainability claims to derive value based pricing. ⊕ Conforms to EUDR (EU Deforestation-free Products Regulation) and ISCC+ standards to support sustainability claims. EUDR carries fines for non-compliance of up to 4% of annual EU revenue) ⊕ Due diligence statement management. ⊖ Benefit of blockchain is to have a provably immutable ledger that is shared by multiple parties. Uploading CSV files as part of the blockchain process questions the value of the blockchain aspect being realised this SAP GreenToken.	⊕ E2E mass traceability solution using a designated platform. ⊕ Combines production data with sustainability information, which is exportable. ⊕ Notifications of breaches. ⊖ Niche alternative. ⊖ Very small use case, only ISCC plus audit.	⊖ No assurance that one single material code corresponds to one single origin. ⊖ Manual process is error-prone. ⊖ Lack of product lifecycle management. ⊖ No single source of truth. ⊖ Circulation of conflicting information. ⊖ Lack of version history	⊕ Traceability of certifiable material usage via goods movements and stock of certificates. ⊕ Process order check is possible if certificate consumption was not made. ⊕ Audits in previous implementations for have been successfully passed using this solution. ⊕ One certificate per raw material number meaning each certified raw material will have a unique certificate. ⊕ Potentially meets ESG expectations (customers/regulators/investors/disclosure) ⊖ The solution only guarantees the proportions of certified /uncertified finished products. ⊖ Identification of certified vs uncertified raw material consumed by the different production processes is not possible with this solution. ⊖ CSRD mandatory requirement of segregation is most important as foundation for all other processes, which is not covered by this solution.
Integration	⊕ Enhanced traceability and transparency across supply chain partners and customers. ⊕ Ability to extract data from declarations received from supplier inbound deliveries. ⊕ Transactional information management for Sustainability. ⊕ Integration with SAP sustainability solutions e.g. SAP Product Footprint Management (PFM). ⊕ SaaS (Software-as-a-service) cloud stand-alone solution. ⊕ Identification of raw materials consumed in which production process is possible with with different materials code (preferable) or with batch management and classification. ⊕ Supply chain collaboration via blockchain technology. ⊖ Blockchain part of the solution only useful if upstream producers and downstream users of Syensqo products will also interact with the tokens. ⊖ Network depends on members of the supply chain where there are slightly different workflows for interacting with online and offline members. ⊖ Blockchain benefit would be to have a provably immutable ledger that is shared by multiple parties who do not need to trust one another. Uploading CSVs means there is no value of the "blockchain" aspect being realised. ⊖ SAP Green Token is new and unproven, with questionable uptake in the industry currently.	⊖ Lack of integration with ERP processes.	⊖ Lack of process integration ⊖ Creating compliance risks. ⊖ Lack of centralised data repository	⊕ BOM as link on purchasing and selling side between purchased or produced raw material. ⊖ Solution more suitable for small volumes of materials or components due to traceability and accountability. ⊖ Might still need to batch manage receipt of received materials. ⊖ Requires creation and confirmation of process orders. ⊖ Identification of certified vs uncertified raw material consumed by the different production processes is not possible with this solution. ⊖ Between goods receipt and creation of BOM is a grey area. Conversion immediately upon goods receipt. Certificates stays until consumes by finished product.

Business Impact	➕ Dynamic mass balance and segregated accounting. ➕ The stand-alone solution for mass balance accounting allows each organisation to control their own data. ➕ Out of the box sustainability reporting for auditing. ➕ Automatic sustainability declaration management (collection, generation, transfer automatically). ➕ Accessibility through open APIs for non-SAP systems and CSV exports. ➕ Ensures traceability as part of Procurement. ➖ Impact on integrated supply chain processes (inbound and outbound) e. g. procurement and manufacturing. ➖ Requires batch management of all raw materials ➖ Master data governance e.g. responsibility of vendor or Syensqo to capture some metadata. ➖ Green Token is new and unproven technology from SAP.	➖ Small start up company founded in 2022. ➖ Lack of trialled and tested solution	➖ Lack of transparency	➕ Allows management of demand of certified and non-certified products. ➖ Means every sustainable raw material requires a certified material. ➖ Solution more suitable for small volumes of materials or components due to traceability and accountability. ➖ Data maintenance on new certified raw materials requiring additional BOM management. ➖ Between goods receipt and creation of BOM is a grey area. Possibility to automate the split after GR with a background task triggered by event that creates and confirms the Split Process Order
Cost	➖ Additional licencing cost. ➖ Potential financial impact in capital expenditure (CAPEX) to allow the implementation of the process.	➖ Additional licencing cost. ➖ Potential financial impact in capital expenditure (CAPEX) to allow the implementation of the process.	➕ No additional licencing required.	➕ Solution does not require additional licencing.

See also

Change log

Version	Published	Changed By	Comment
CURRENT (v. 87)	**Oct 09, 2024 14:13**	**SCHWARTZ-ext, Stefanie**	
v. 86	Oct 09, 2024 14:04	**SCHWARTZ-ext, Stefanie**	

v. 85	Oct 09, 2024 14:03	**SCHWARTZ-ext, Stefanie**
v. 84	Oct 07, 2024 17:53	**SCHWARTZ-ext, Stefanie**
v. 83	Oct 07, 2024 17:52	**SCHWARTZ-ext, Stefanie**
v. 82	Oct 07, 2024 17:51	**SCHWARTZ-ext, Stefanie**
v. 81	Oct 07, 2024 17:46	**SCHWARTZ-ext, Stefanie**
v. 80	Oct 07, 2024 17:45	**SCHWARTZ-ext, Stefanie**
v. 79	Oct 07, 2024 17:40	**SCHWARTZ-ext, Stefanie**
v. 78	Oct 07, 2024 17:40	**SCHWARTZ-ext, Stefanie**

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Workflow history

Title	Last Updated By	Updated	Status
There are no pages at the moment.			

Workflow history

This view shows the 5 most recent entries. The complete workflow log is available from the 'Document Activity' menu item.

Oct 21, 2024	Actor	Type	Activity	Version
Approved	FALL-ext, Cheikh	State	changed state to Approved at 7:37 am	v87
Pending SteerCo Review	FALL-ext, Cheikh	State	gave *Final Approval* approval at 7:37 am	
		State	changed expiry date to '04 Nov, 2024 08:37 am' at 7:37 am	
		State	changed state to Pending SteerCo Review at 7:37 am	v87
Pending Stakeholder Review	FALL-ext, Cheikh	State	gave *Stakeholder Review* approval at 7:37 am	
		State	changed expiry date to '28 Oct, 2024 08:37 am' at 7:37 am	
		State	changed state to Pending Stakeholder Review at 7:37 am	v87
Edited following DA Endorsement	FALL-ext, Cheikh	State	gave *Minor change* approval at 7:37 am	
Oct 09, 2024				
	SCHWARTZ-ext, Stefanie	Edit	updated the page at 2:03 pm	