

**Platform
Hernieuwbare
Brandstoffen.**

Concluding workshop: Digital transparency and the POME supply chain

Tuesday 27 January 2026, online

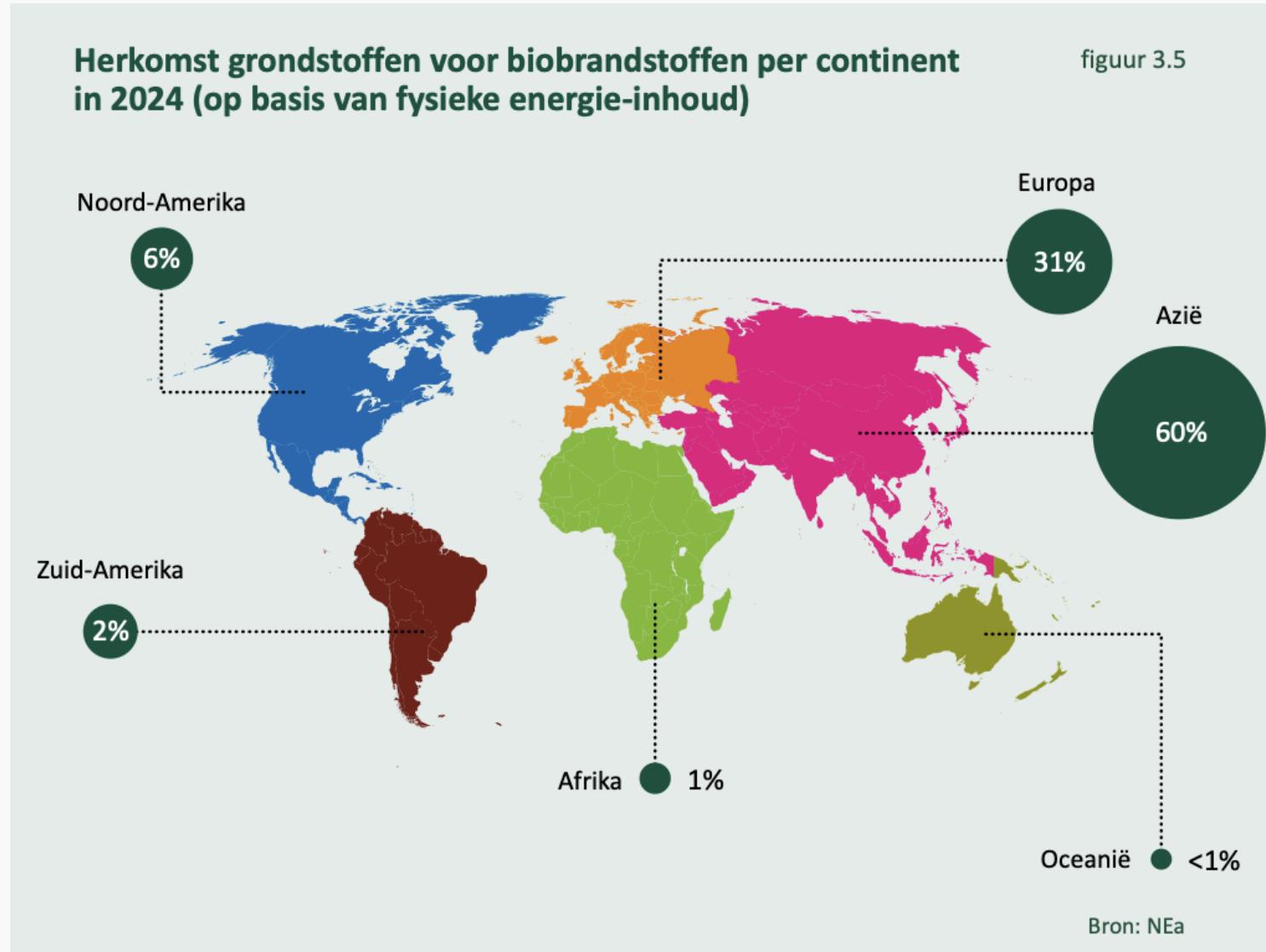
**Loes Knotter, Jouk Hogenhuis, Emma
Beroske**



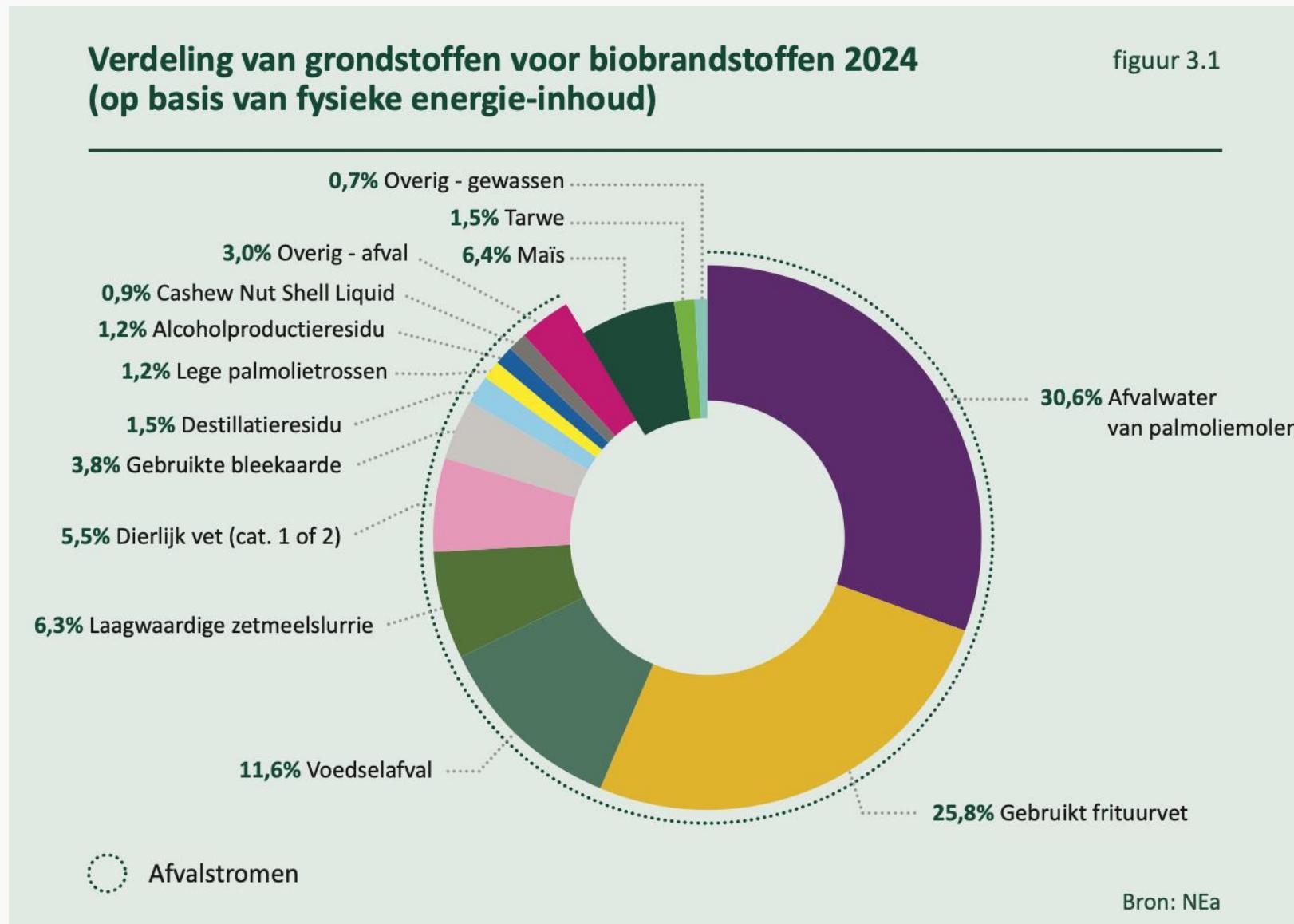
Agenda

- Introduction and goal of the project
- Main findings
 - Insights on residual oil practices at palm oil mills
 - Additional data points to strengthen transparency
 - Clean Fuel Protocol and UNTP principles applied to the POME biofuel supply chain
 - Improving traceability system with the use of interoperable protocol
 - European chain of custody system
- Discussion

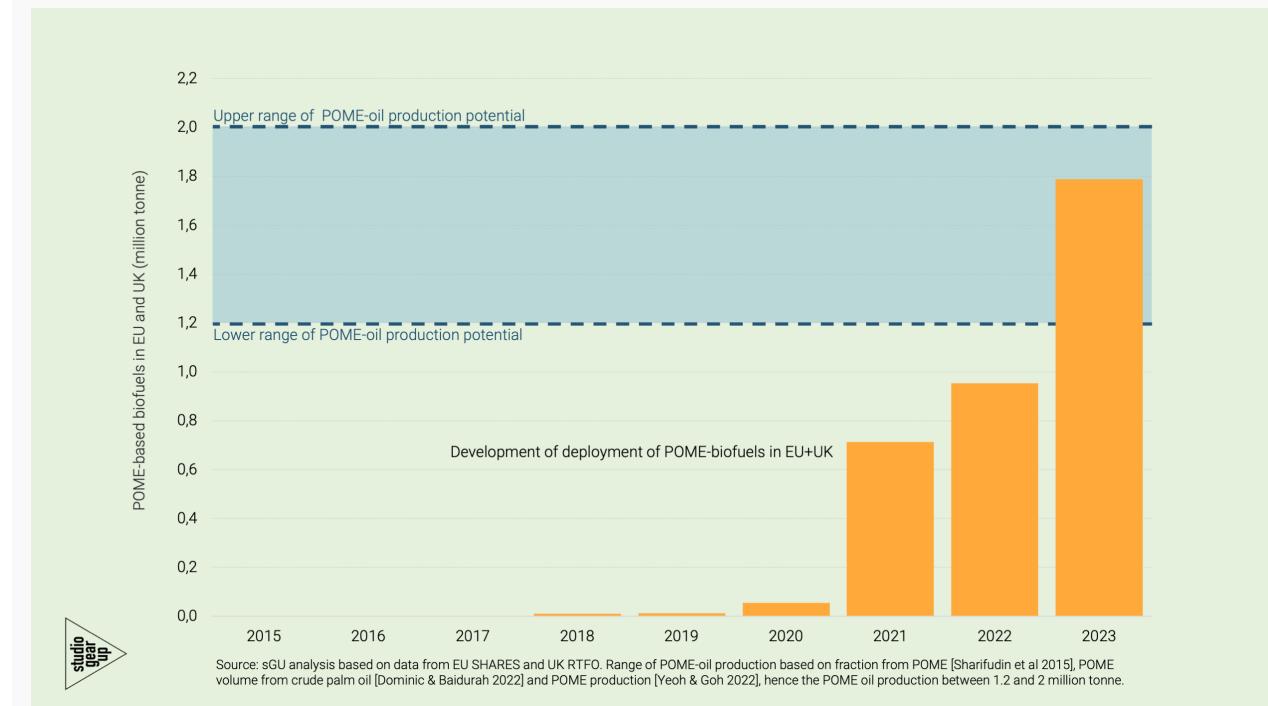
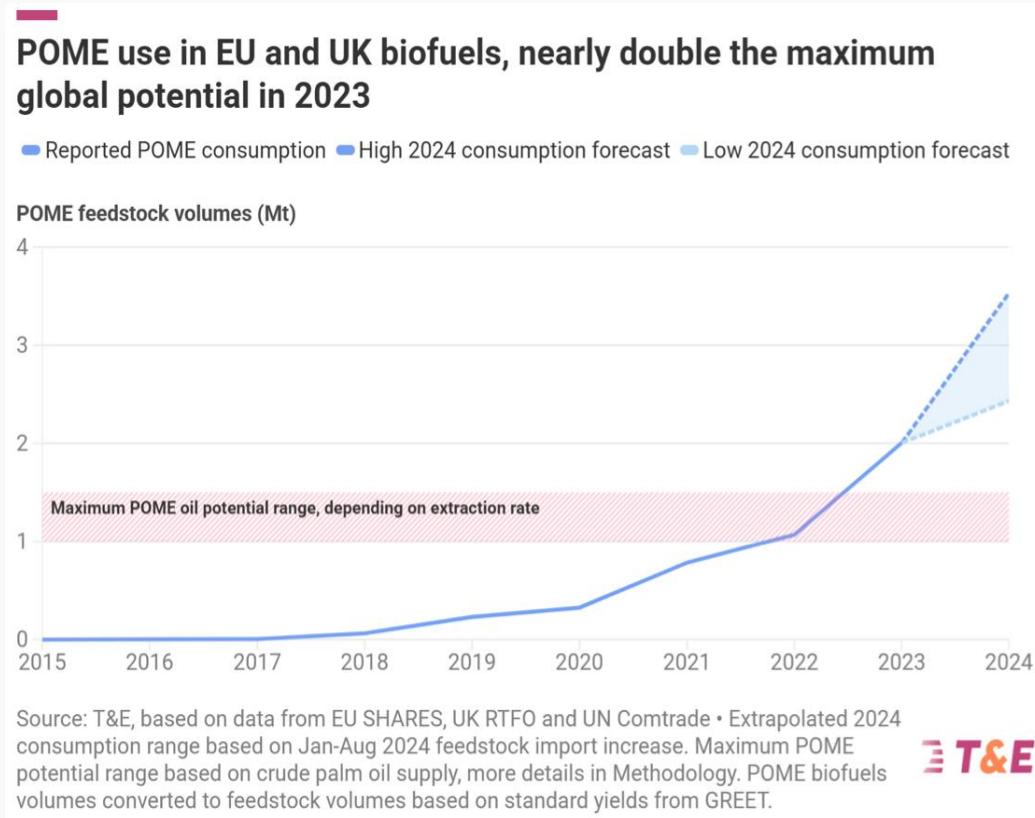
Import of biofeedstocks and biofuels from overseas for the Dutch market is growing



Palm Oil Mill Effluent (POME) is an important feedstock for the Dutch market



In 2025, T&E report with concerns that European POME-based biofuel are reaching limit of POME production potential. PHB response with an sGU analysis that palm oil mill residues fall within expected waste potentials



Promoting the use of residues as sustainable feedstock creates new value for otherwise a waste product while incentivising the use of pure products.

- The use of residue streams can provide many advantages for instance by addressing environmental challenges, providing alternatives to the use of new virgin fossil oils and generating additional income in regional economies .
- However, in the case of palm oil, it can also provide an incentive for the use of pure palm oil if the residue is worth more than the palm oil itself in the food chain.

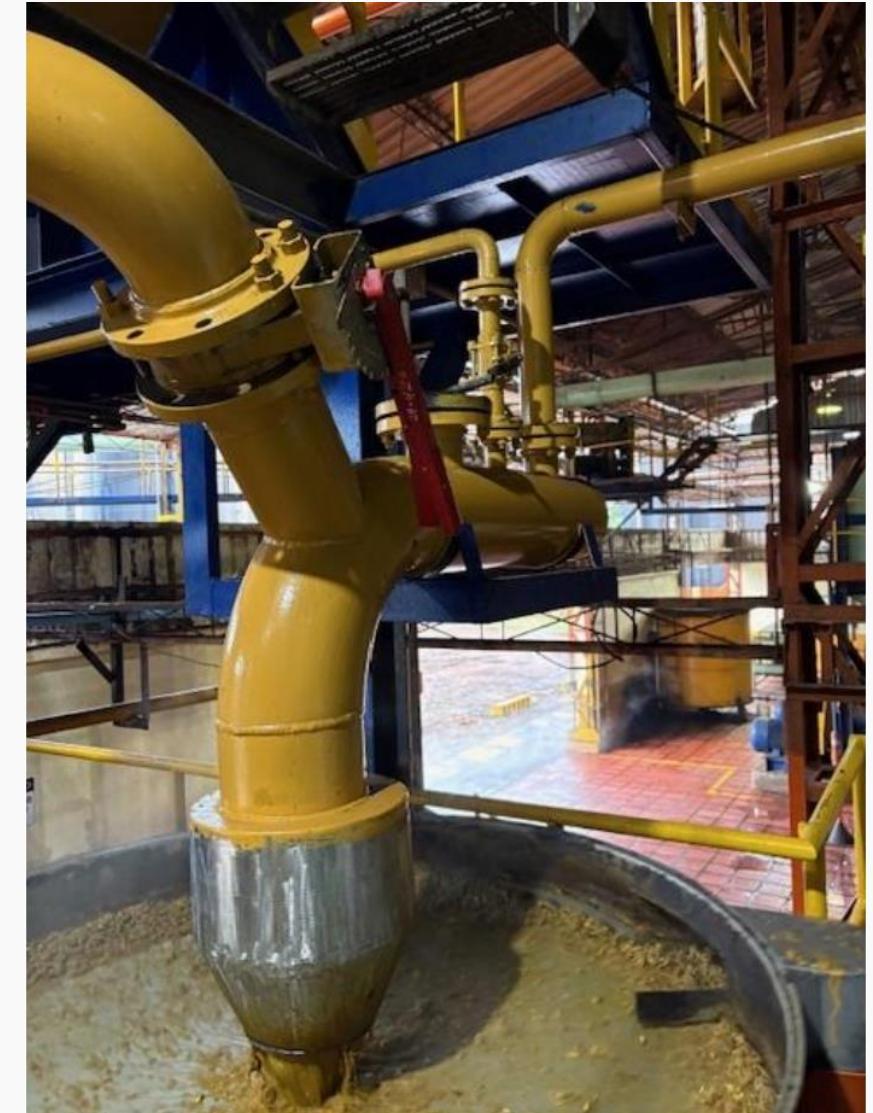
→ In this project, we explore how the use of verifiable credentials (i.e. in systems based on distributive ledger technology) could strengthen transparency and support the certification system.

Goal and research question of the project on digital transparency in the POME supply chain

- This project aims to investigate how this digital traceability and the link to the Clean Fuel Contract protocol can contribute to better verification and transparency in the POME biofuel chain.
- The following questions were explored:
 - How can we use the Digital Product Passport and Correlated Digital Traceability Events (DTE)? (see [UNTP](#)) improve transparency in the supply chain, in this case specifically applied to the concrete POME-oil based sustainable biofuels ?
 - What (additional) data points can we identify that support the verification of the residue oils?
 - Can the use of the UNTP interoperability protocol and decentralised data architecture help to improve public oversight and private audit tasks?
 - What does this mean for governance (organisational aspects) including the link with the Union Database for Biofuels?

Practices on the ground and accounts from palm oil mill operations in Indonesia and Colombia

- Practices may vary from mill to mill
- POME is a mixture of oils originating at the mill
 - Condensate oil and sludge oil, and oil pressed from empty fruit bunches are all collected in the same container
- In Colombia, palm oil mills are equipped with testing equipment which allows them to verify the oil recovery rates and losses.
 - Generally, more positive attitude towards sharing data in Colombia
- Once the batches have left the palm oil mill facility, they are not traced physically (but administratively)



Source: Photo taken by Wolter Elbersen when visiting a Palm oil mill in Colombia

Sensing technologies for fingerprinting

- Optical sensing technologies allows to fingerprint solid and liquid samples in terms of their chemistry
- Infrared and Raman spectroscopy allows to fingerprint in terms for organic molecules such as fats, acids etc.



Infrared spectrometer



Handheld Raman



Handheld NIR

Sensing technologies for fingerprinting

- Fluorescence spectroscopy is another optical technique which is more sensitive to minor components such as vitamins, polyphenols, carotenoid, chlorophyll, and secondary oxidation products as well



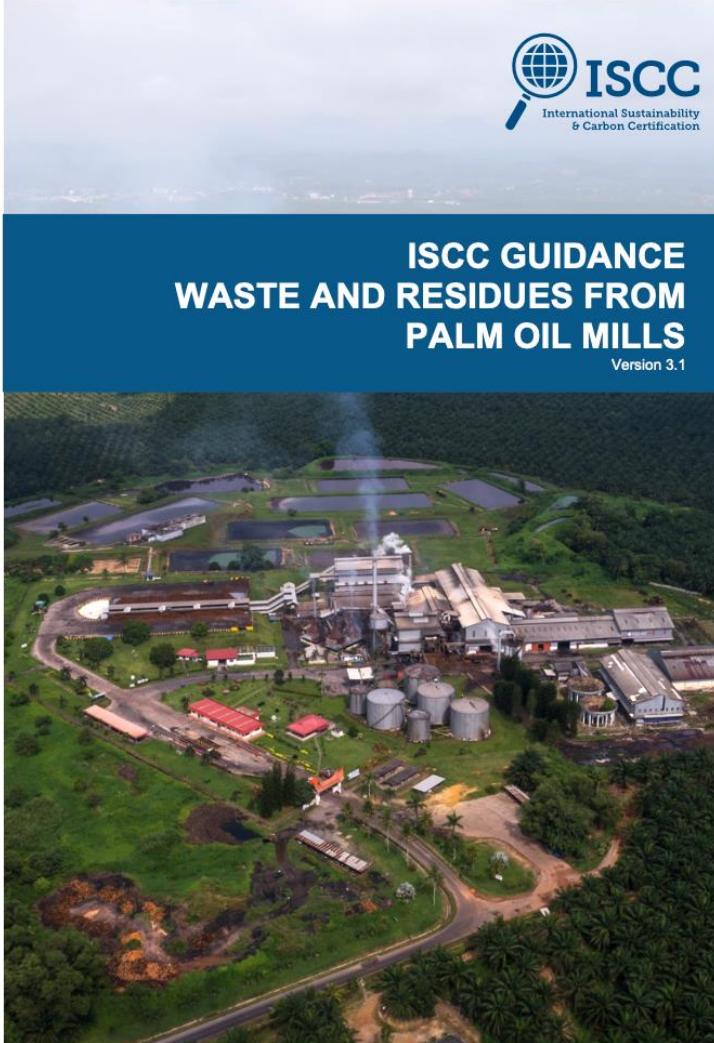
Concluding remark: it is possible to add a fingerprint on samples of POME batches

- Adding a fingerprint is possible to improve the verification of POME and is an affordable option
- Chemical lab analysis on the other hand is very expensive.
- Sensing technologies can also provide a quick and affordable way to show the composition of a POME batch.
 - However, fingerprint technology needs to be calibrated.
- Although including a fingerprint is possible, we must ensure that it adds additional value.

Deep dive into ISCC guidelines: the current sustainability certification guidance for waste and residues from palm oil mills is very solid and complete.

9

ISCC GUIDANCE WASTE AND RESIDUES FROM PALM OIL MILLS



6.2 Guidance for the Audit of a Palm Oil Mill (POM) generating Waste and Residues

The following steps shall be conducted by the auditor

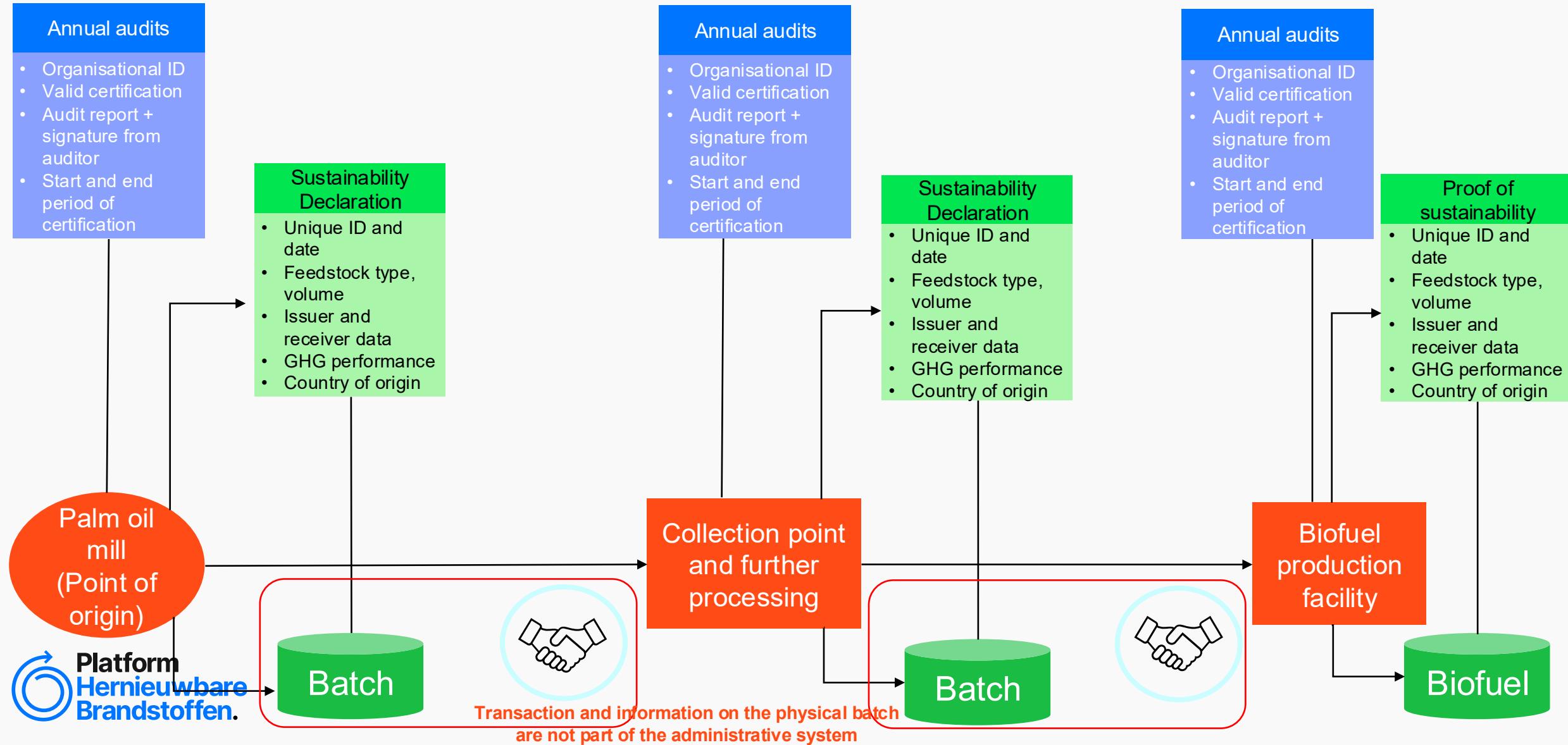
- Check the annual production capacity of crude palm oil of the POM (shall be indicated in the ISCC audit procedure)
- Check how many FFBs (in metric tons) have been processed by the POM in the 12 months period prior to the audit (shall be indicated in the ISCC audit procedure)
- Check what type of sterilizer is used (horizontal or vertical) in the POM
- Check how POME oil is recovered, i.e. from the pond or prior to the pond (shall be indicated in the ISCC audit procedure)
- If POME oil is recovered before discharging the POME to the pond, check that the respective technology is available and functioning (visual inspection, layout plan, process diagram, etc.). Check where the recovered POME oil is stored.
- If the POM recovers EFB oil and/or PPF oil, check that the respective technology is available and functioning and where the recovered oil is stored (visual inspection, layout plan, process diagram, etc.).
- Check how much POME oil / EFB oil / PPF oil was generated by the POM in the 12 month period prior to the audit (shall be indicated in the ISCC audit procedure)
- Check if the recovered POME oil / EFB oil / PPF oil is further treated (e.g. purified, cleaned, etc.) and if yes, where this treatment is conducted and that losses from the process are taken into account appropriately
- Check how many recipients collected/received POME oil / EFB oil / PPF oil from the POM in the previous certification period
- Check how often POME oil / EFB oil / PPF oil was collected from the mill (verify respective delivery documents, contracts, etc.)
- Check the outgoing sustainability declarations
- Check if the POM delivers POME oil / EFB oil / PPF oil under other voluntary or national sustainability certification schemes (e.g. RSPO, Italian National System, etc.). If this is the case, deliveries and amounts sold under the respective other scheme(s) must be included in the verification process to ensure that no double-accounting of POME oil / EFB oil / PPF oil takes place between different systems.
- Verify the plausibility of the amounts of POME oil / EFB oil / PPF oil generated and sold by the POM by using the figures displayed in the respective process diagrams in this guidance document
 - Note: The plausibility of the amount of POME oil recovered at a POM depends on the methodology to recover the oil. Recovery from the pond („skimming off“) is less efficient than recovery in a pre-treatment step like a centrifuge.
 - Note: If the amount of POME oil / EFB oil / PPF oil generated by a POM is higher than the figures shown in the previous slides, an in-depth analysis must be conducted by the auditor at the POM. The

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Concluding remark: ISCC sustainability certification system is very solid

- Palm oil mills are audited on an annual basis in which many aspects are checked:
 - Annual production of crude palm oil and residues oils.
 - Recovery technique used
 - Skimming or centrifuge equipment
 - Type of steriliser
- Annual audit includes a check on whether volumes fall within a reference range, that is based on the parameters under which the palm oil mill operates (recovery technique, pre-treatment, type of steriliser etc.).
- In sum: on an annual basis, audits provide a check on physical volumes.

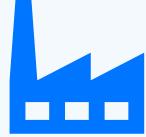
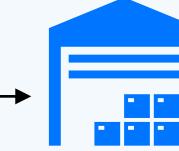
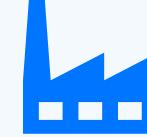
Data points in the current administrative sustainability certification system



Union Database for biofuels organises information collected along the supply chain

Union Database for Biofuels								
POME supply chain	Palm oil mill (point of origin)	Batch	Transaction	Collection point and further processing	Batch	Transaction	Biofuel production facility	Biofuel
	Organisational ID	Sustainability Declaration	Trade event	Organisational ID	Sustainability Declaration	Trade event	Organisational ID	Proof of sustainability
Administrative information	<ul style="list-style-type: none"> • Certification number • Validity period • Audit report and signature from auditor 	<ul style="list-style-type: none"> • Unique batch ID and date • Feedstock type and volume • Issuer and receiver data • GHG performance • Country of origin 	<ul style="list-style-type: none"> • Unique batch ID • Signature from trading parties • Date of trade 	<ul style="list-style-type: none"> • Certification number • Validity period • Audit report and signature from auditor 	<ul style="list-style-type: none"> • Unique batch ID and date • Feedstock type and volume • Issuer and receiver data • GHG performance • Country of origin 	<ul style="list-style-type: none"> • Unique batch ID • Signature from trading parties • Date of trade 	<ul style="list-style-type: none"> • Certification number • Validity period • Audit report and signature from auditor 	<ul style="list-style-type: none"> • Unique batch ID and date • Feedstock type and volume • Issuer and receiver data • GHG performance • Country of origin

In this project, we explore the possibility of adding physical information on a batch level which could occur at several points along the supply chain and uploaded to the UDB.

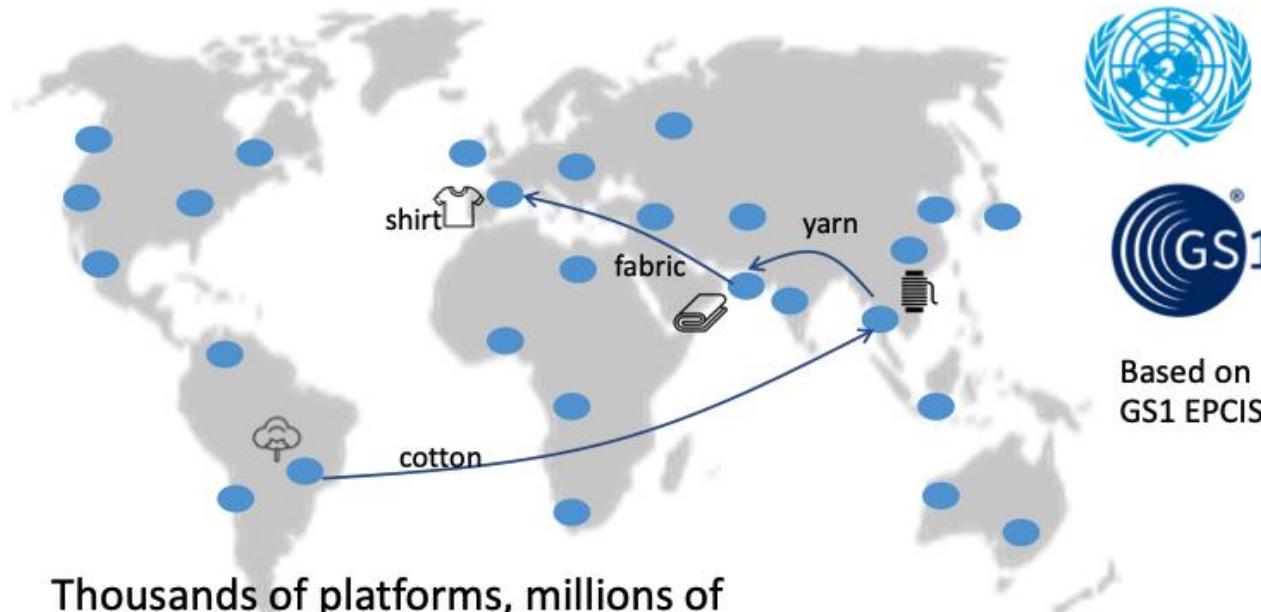
Union Database for Biofuels											
POME supply chain	 →  →  →  →  →  →  → 		Palm oil mill (point of origin)		Batch	Transaction	Collection point and further processing	Batch	Transaction	Biofuel production facility	Biofuel
	Organisational ID	Sustainability Declaration	Trade event	Organisational ID	Sustainability Declaration	Trade event	Organisational ID	Proof of sustainability			
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Physical information		<ul style="list-style-type: none"> • Chemical fingerprint of batch 			<ul style="list-style-type: none"> • Chemical fingerprint of batch 						

UN Transparency Protocol (UNTP) has developed a lot of thinking on how to address these issues – how can digital technologies help improve transparency in supply chains?

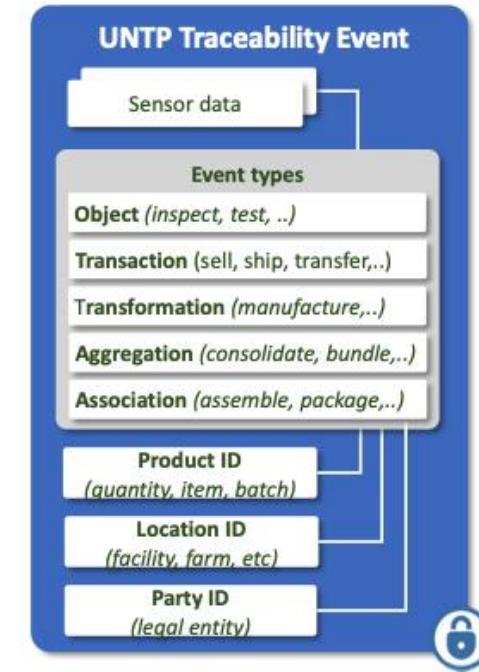
#1 – UNTP is an interoperability protocol, not a platform

Leave data where it is but link it together when needed using decentralised events.

Use any software you like – so long as it conforms to UNTP.



Based on
GS1 EPCIS



We translate the interoperability protocol of UNTP and how it could be applied to improve digital traceability of POME

Information that is part of the current certification system is logged in the form of verifiable credentials

These types of events are additional data points that could be added to the system

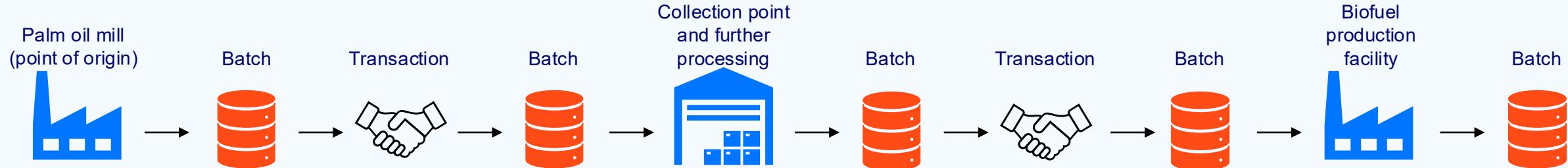
<input checked="" type="checkbox"/> Object event	Annual sustainability audit	Signed by verified organisational ID (CB, Auditor)
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<input checked="" type="checkbox"/> Transaction event	POME batch changes owner	Signed by both involved parties with verified organisational ID
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<input checked="" type="checkbox"/> Object event	Annual sustainability audit	Signed by verified organisational ID (CB, Auditor)
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<input checked="" type="checkbox"/> Transaction event	POME batch changes owner	Signed by both involved parties with verified organisational ID
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<input checked="" type="checkbox"/> Object event	Annual sustainability audit	Signed by verified organisational ID (CB, Auditor)
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<input checked="" type="checkbox"/> Object event	Lab test to confirm the chemical composition of POME oil	Signed by verified organisational ID of lab
--	--	---

<input checked="" type="checkbox"/> Aggregation event	POME oil batches are mixed for storage and further distribution	Signed by verified organisational ID of operator
---	---	--

<input checked="" type="checkbox"/> Transformation event	Processing of POME into HVO	Signed by verified organisational ID of operator
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<input checked="" type="checkbox"/> Association event	Addition of a chemical tracer	Signed by verified organisational ID of operator
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<input checked="" type="checkbox"/> Object event	Sensing test on POME oil to ensure the product they sell is on spec	Signed by verified organisational ID of operator
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<input checked="" type="checkbox"/> Object event	Sensing test on POME oil to ensure the product they buy is on spec	Signed by verified organisational ID of operator
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<input checked="" type="checkbox"/> Association event	Removal of chemical tracer	Signed by verified organisational ID of operator
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What benefits can Digital Transparency solutions bring

- Improve the information position of different economic operators along the POME supply chain
- Federated and encrypted data
 - Ownership of data stays with relevant supply chain actors
 - Data is secured through encryption
 - Owner chooses who they grant access to what information (decentralised access control)
- Traceability along the full supply chain with linked data
 - Enables to map the full supply chain
- Interoperability with different systems
 - Allows operators to manage data in one way, but connect to different compliance systems
- Verifiable data
 - Supply chain events are recorded as verified data events (digital traceability events)
 - Any supply chain event can be traced back to a verified legal entity

Concluding remarks

- The data is already organised in the administrative sustainability certification
- The current paper trail could very easily be turned into the verifiable credentials by basing it on an open standard
- From an unpublished source:
- “By use of the W3C Verifiable Credential: an open standard for exchanging cryptographically verifiable data. In order to automate and regulate complex chains, data within the Clean Fuel Protocol must meet the following characteristics:
 - Structured and machine-readable, so that data can be efficiently processed and interpreted by systems (unlike paper, PDF and Excel);
 - Cryptographically signed with a legally traceable company identity, so that it is possible to prove who issued the data and that the content has not been altered. This makes the issuer accountable and prevents them from denying the data issued afterwards;
 - Suitable for use as Linked Data, allowing individual data points to be linked together in a consistent and scalable manner, particularly for the purposes of supervision and regulation.

These properties form the core of the W3C Verifiable Credentials Data Model v2.0. Within the United Nations Transparency Protocol (UNTP), and therefore also within the Clean Fuel Protocol, relevant data points are modelled as Verifiable Credentials.”

A decentral data system with verifiable credentials could improve the transparency of POME supply chain

Improve the administrative system, make use of the data collected along the POME supply chain

1

Be aware of the common practice to aggregate residue oils at palm oil mills

2

Sector players could organise the data according to the UNTP protocol – and search for interoperability with UDB

3

Make use of the central database: opportunity to use the data in the UDB to establish annual POME oil volume thresholds

4

A physical verification could contribute to strengthening transparency – depending on whether it is turned into a verifiable credential

5

Set up a follow up research project with supply chain actors in POME producing countries including local government players

Choices in the European chain of custody system for proving sustainability and principle choice for a central database

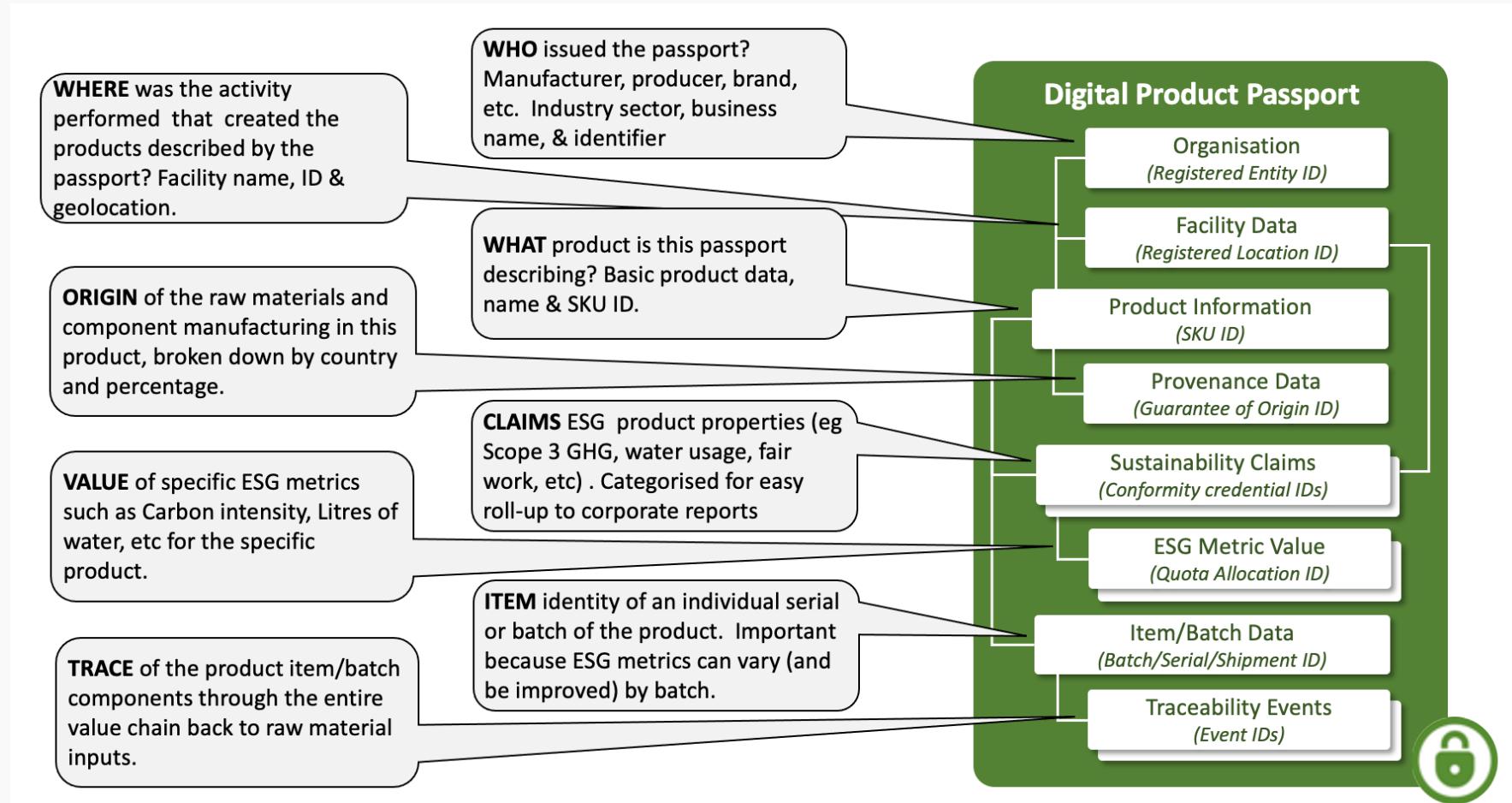
- This project touches upon higher fundamental principles in Europe in which chain of custody information is organised in an administrative and central way.
- Partly, the current administrative system could easily be based on a federal and decentral system that would enable adding point of physical verification.
- A decision on what system to follow needs to be made on a European level.

Administrative (certification)	Central database (UDB)
Physical verification	Federal / Decentral

Extra slide

Digital Product Passports can hold verified and secured data credentials

- The concept of Digital Product Passport is being investigated in the Clean Fuel Protocol innovation project with RVO, TNO and the NEN.



Source: UN Transparency Protocol, Digital Product Passport (see UNTP page on the [website](#))

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