The Development of SCS in China: Progress and Perspectives

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01 Background

Background | Enabler in China's SAF Industry

1st Dedicated SAF research institute in China

80+ Partners covering entire SAF value chain

RMB 200M+ Investments in SAF R&D



Supporting government

- Supported CAAC in SAF pilot application
- Assisting government in SAF industry trends, policies and roadmaps research



Serving industry

- Launched China's SAF Alliance
- Supporting R&D and application in SAF industry
- Building full-process of airworthiness capacity and industrial database

Pioneering innovation

- The first civil aviation carbon emission verification body certified by CNAS
- Collaborating across the SAF value chain on sustainability certification research
- Establishing the SAF standard system in China

Background | Definition & Key characteristics

Definition

sustainability certification schemes (SCS) is an integrated framework of standards, procedures, documentation, and information systems that ensures compliant sustainability assessments and credible results for aviation fuels.

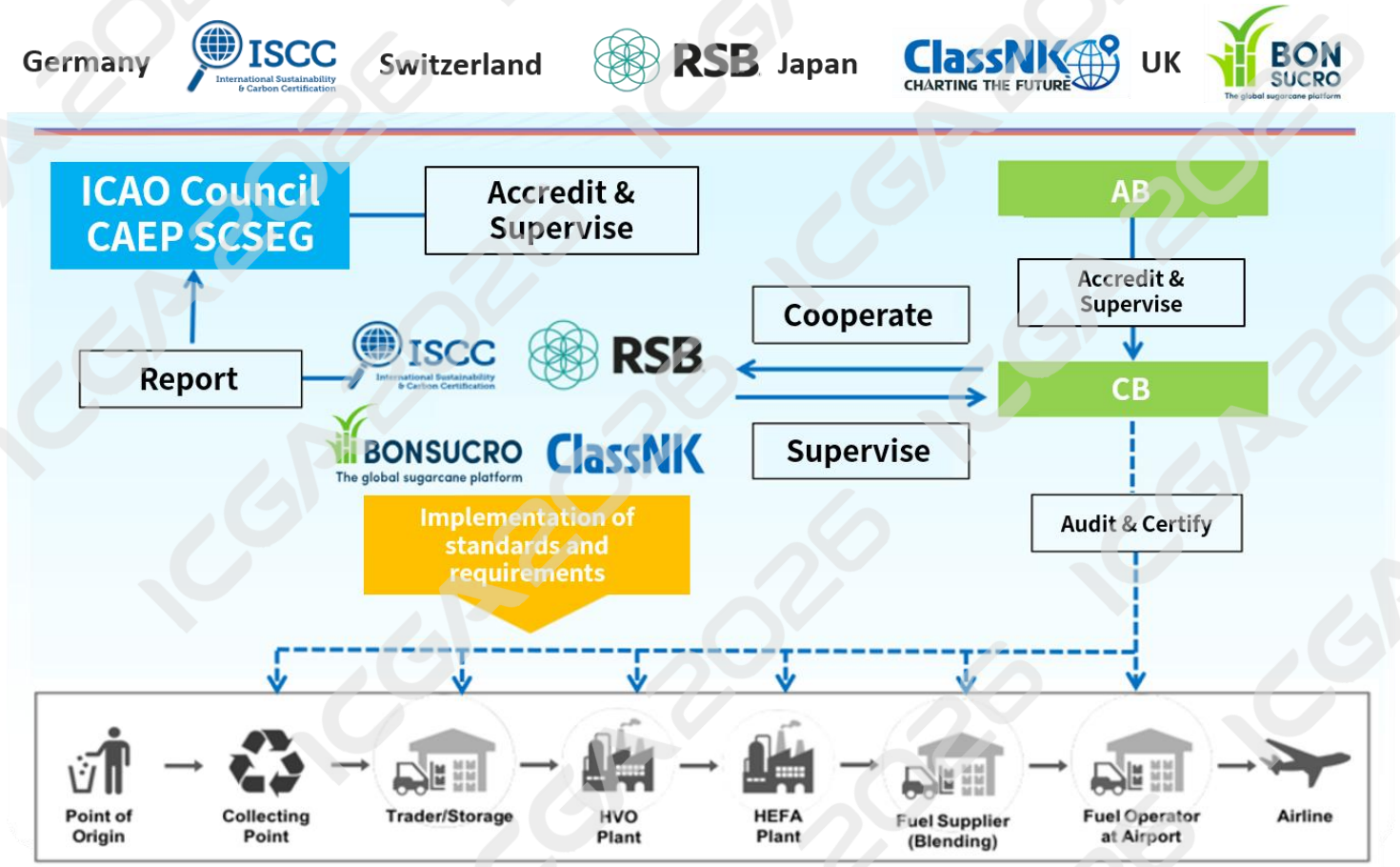
An SCS covers sustainability criteria, requirements for certification bodies and economic operators, as well as governance, operational procedures, and oversight and enforcement mechanisms.

Key Characteristics

Full Supply Chain Coverage	Audits cover the entire supply chain, from raw material production and collection through processing, fuel production, and trade and distribution.
Full-Process Assessment	Authorized assessment bodies conduct document reviews and on-site inspections and are accountable for their respective assessment systems.
Multi-Level Oversight	Competent authorities assess and continuously supervise assessment bodies; the scheme manages the bodies, which in turn audit market participants.
Traceability Mechanism	Chain-of-custody systems link sustainability attributes to physical fuel. The fuel industry mainly uses a mass-balance approach, enabling accurate quantitative traceability when compliant and non-compliant materials are mixed.

SCS is essential for ensuring the sustainability of SAF production and related activities, supply chain traceability, and the quantification of greenhouse gas (GHG) emission reductions

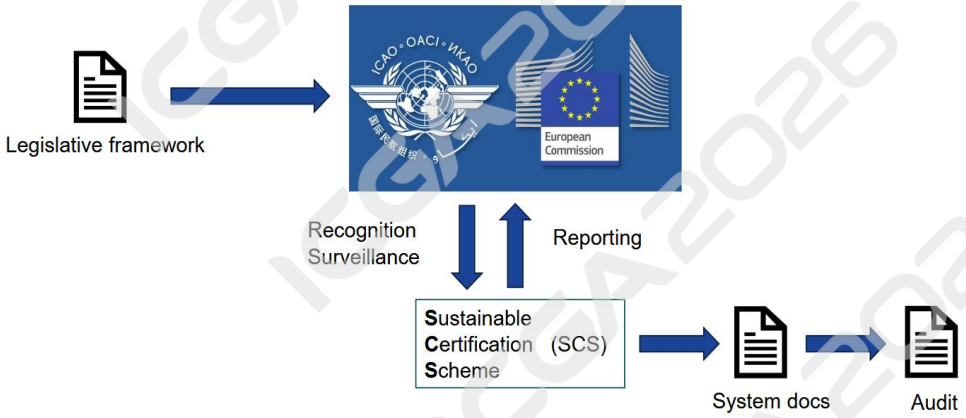
Background | ICAO CORSIA



- 4 SCSs including ISCC/RSB have been approved by ICAO currently
- 3rd party Certification Body conduct audit activities according to the above SCSs, ensuring the uniformed standard globally

Background | EU RED

- EU has approved a total of 18 schemes to certify biofuels/SAF which exported to the EU
- ISCC EU is currently the scheme with the broadest product coverage and the highest level of recognition

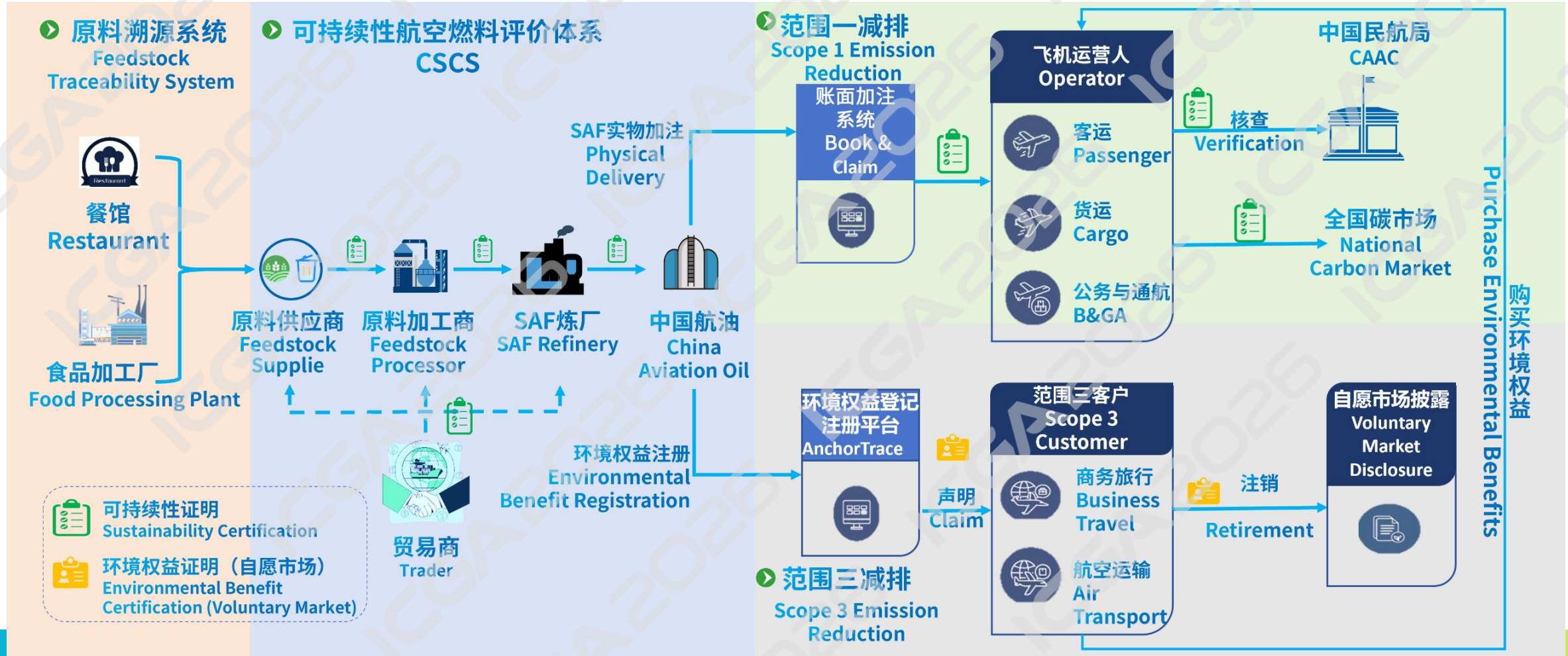


Sustainability certification schemes recognized by the EU: 18 in total

- International Sustainability and Carbon Certification (ISCC)
- Bonsucro EU Certification Scheme (Bonsucro)
- Round Table on Responsible Soy (RTRS)
- Universal Feed Assurance Scheme (UFAS)
- Red Tractor Farm Assurance Scheme (Red Tractor)
- Renewable Energy Directive Certification Scheme (Red Cert)
- Better Biomass
- Sustainable Resources Voluntary Scheme (SURE)
- Roundtable on Sustainable Biomaterials (RSB)
- Sustainable Biomass Program (SBP)
- Voluntary Scheme for Biomass Fuel Sustainability (2BSvs)
- Abengoa Bioenergy Sustainability Assurance Scheme (RBSA)
- Polish Sustainable Biofuel Certification Scheme (KZR INIG)
- Scottish Quality Crops Scheme (SQC)
- Austrian Agricultural Certification Scheme (AACS)
- ……

Source: https://energy.ec.europa.eu/topics/renewable-energy/bioenergy/voluntary-schemes_en

Background | Application



02 Progress in building SCS in China (CSCS)

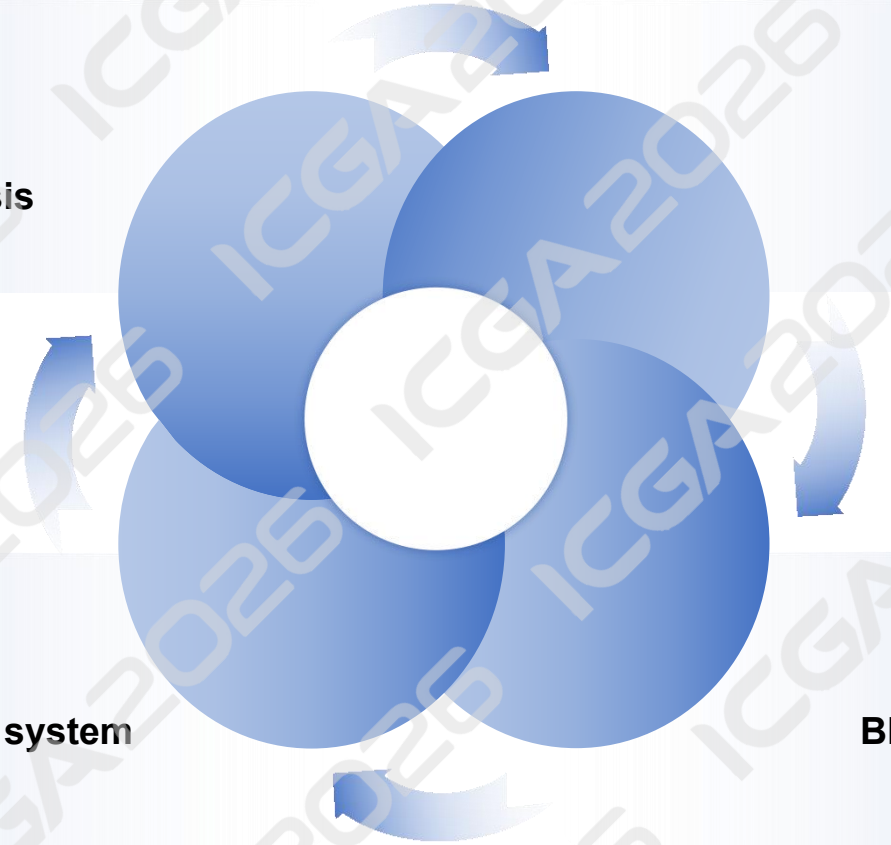
Progress in building CSCS | Governance

Normative documents

Top-level institutional basis

Technical standards

Core technical support



Certification scheme

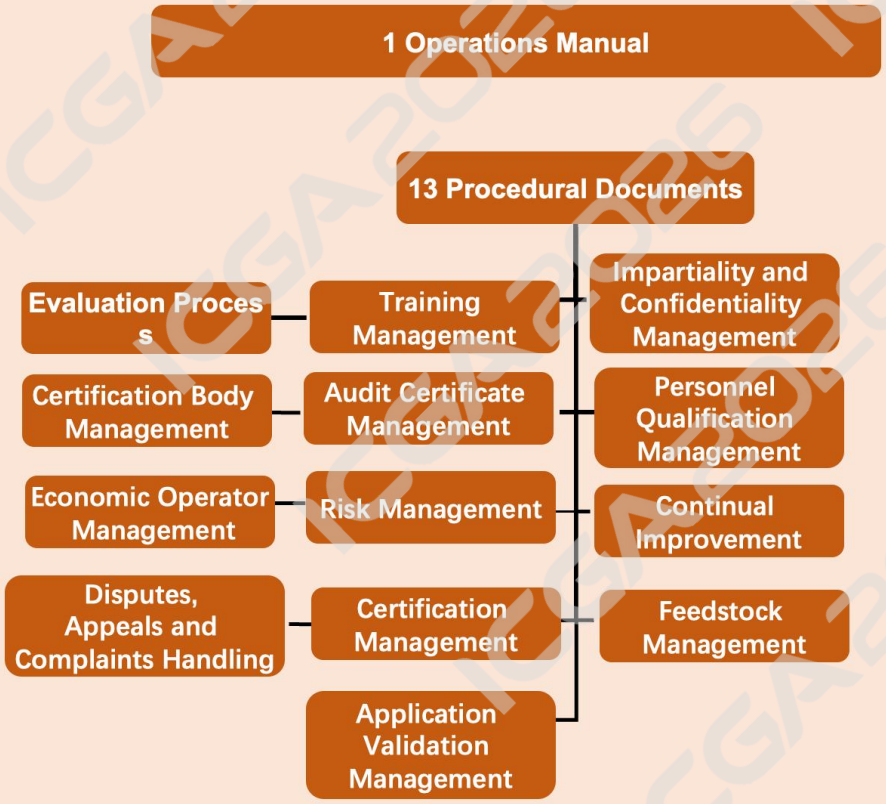
Full-process management system

Operating platform

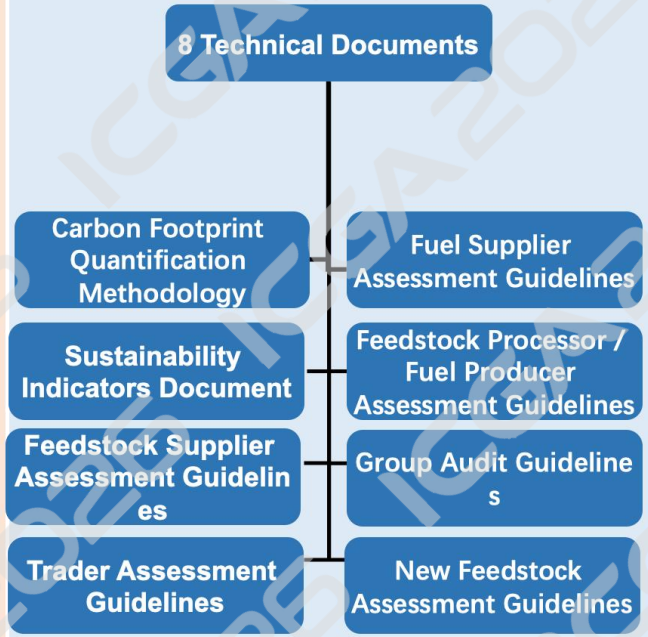
Blockchain-based digital tool

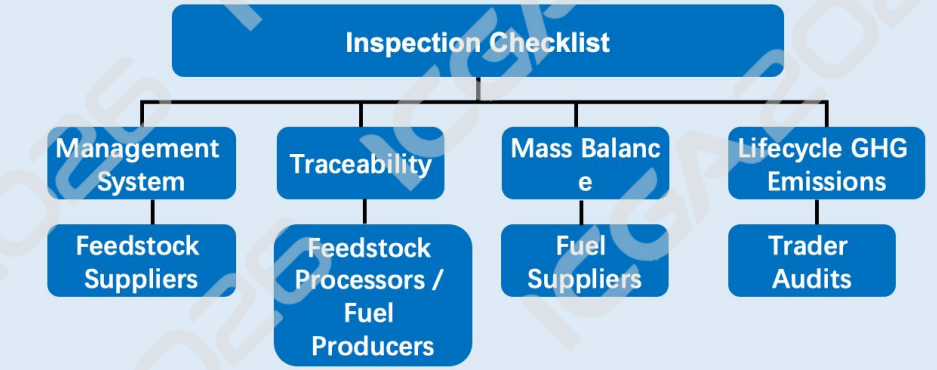
Progress in building CSCS | Framework

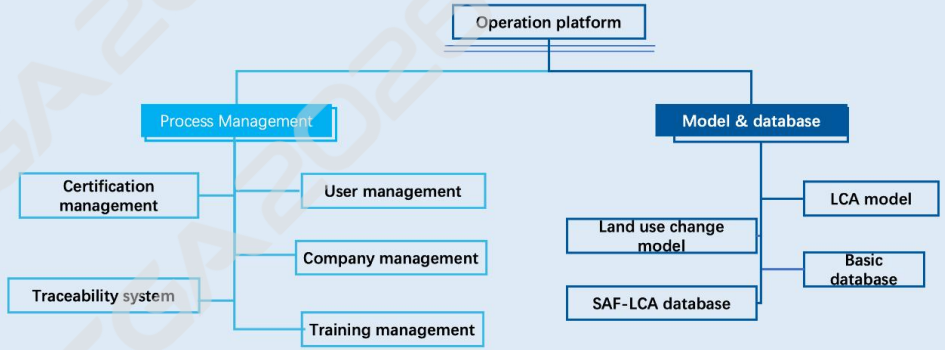
Management Documents



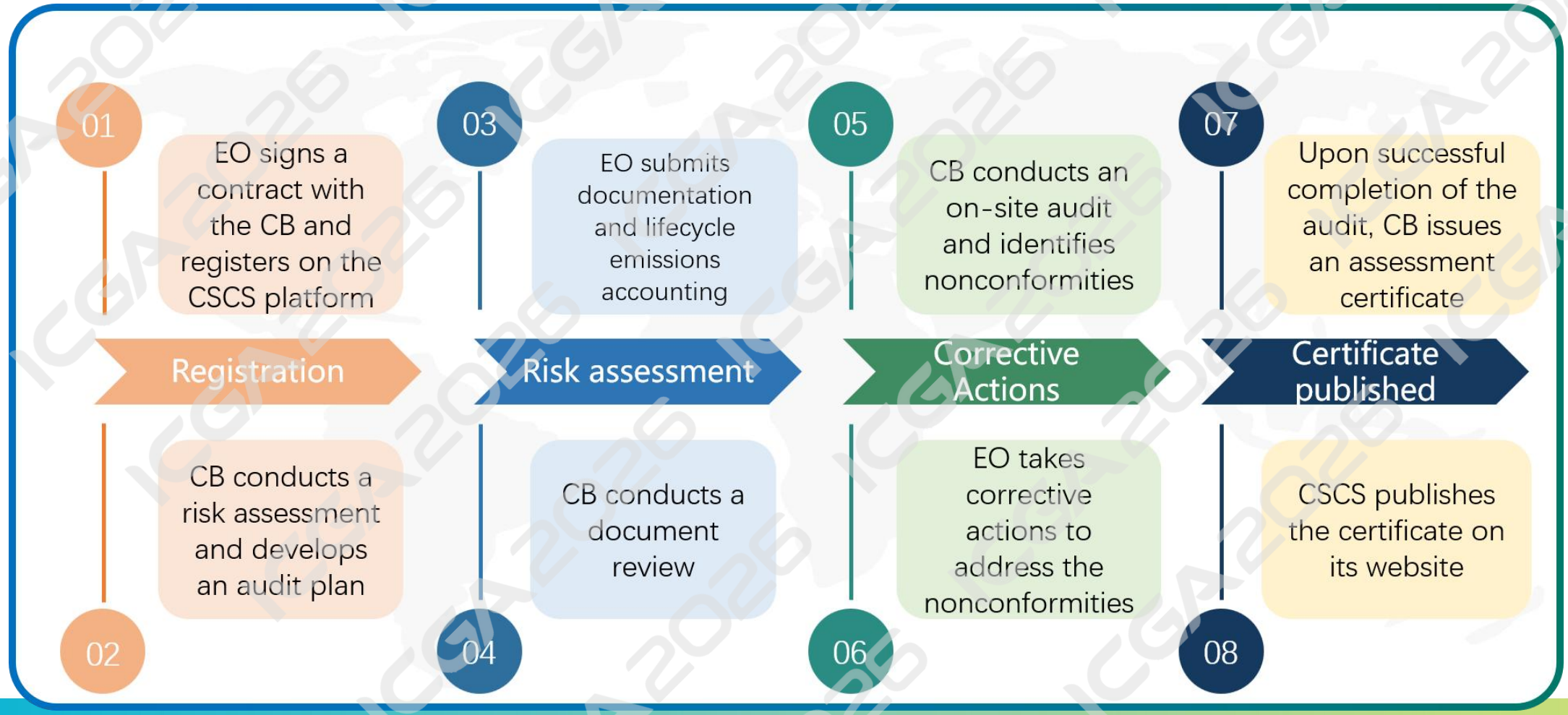
Technical Documents and Operating Platform







Progress in building CSCS | Auditing procedure



Progress in building CSCS | Core elements



Feedstock sustainability compliance



Lifecycle emission reduction



Chain of custody



Social and economic sustainability safeguard



Auditors and certification bodies qualification



Application & validation

Six core dimensions jointly underpin every certification result

Progress in building CSCS | Feedstock sustainability compliance

01 **Sustainability criteria**

15 indicators in Environmental/ Economic/Social

02 **Classification**

Main products/ Co-products/By-products/Waste/Residues

03 **Carbon footprint**

CFP = Core LCA + LUC

- CSCS helps to unlock the potential of China's resource endowment
- Industrial off-gas, waste bamboo, distiller's grain, organic hazardous waste, cottonseed oil, renewable hydrogen/electrify/natural gas ...

Progress in building CSCS | Lifecycle emission reduction

$$CFP = \frac{\sum(AD_{m,i} \times EF_{m,i,n} \times GWP_n) + \sum(IN_{m,j} \times CFP_j) + \sum R}{(E_{SAF} + E_{co-product}) \times 1000} + \sum DLUC_j$$

01 Direct emissions from fuel consumption

Formula: Σ (AD × EF × GWP)

Account for direct emissions from fuel combustion at all stages of production. Based on the IPCC 202 1 GWP) values, accurately quantify the contribution of energy consumption such as coal and natural gas to the greenhouse effect.

02 Indirect emissions from purchased energy

Formula: Σ (IN × CFP)

Trace cradle-to-gate carbon emissions from purchased materials, covering the entire process of raw material extraction, processing and transportation to the manufacturing site. Key raw materials are traced via the sustainability assessment system to deliver complete lifecycle carbon footprint accounting across the full supply chain.

03 GHG removal

Formula: Σ R

Incorporate greenhouse gas (GHG) removals from technologies such as carbon capture and storage (CCS) and biological carbon sequestration. Emissions are recorded as positive values and removals as negative values to accurately reflect net carbon emissions.

04 multi-product allocation

Energy-based allocation method

When a single production unit yields multiple products, carbon emissions must be allocated based on the proportion of each product's lower heating value (LHV / energy content), rather than by mass or volume. This approach is aligned with internationally accepted accounting rules and ensures the comparability of calculation results across all types of SAF fuels.

- Calculation logic complies with both ISO standard and CORSIA methodology
- Energy-based allocation ensures the accurate comparison of various SAF products

Progress in building CSCS | Lifecycle emission reduction

Six control measures ensure the **accuracy** of the calculation results

01 Complete Coverage

02 Measured Data First

03 Controlled Emission Factors

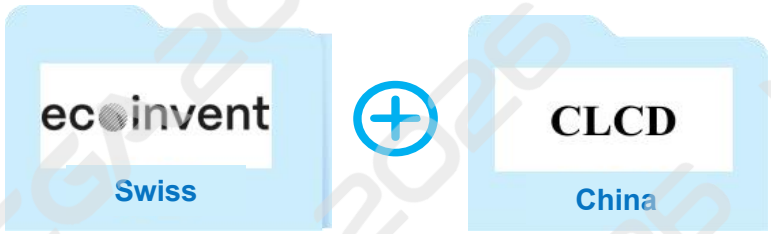
04 Consistent Allocation

05 Conservative Assumptions

06 Reproducible Results

Carbon footprints cannot be measured directly. **Accuracy relies on complete boundaries, reliable data, authoritative emission factors, reproducible calculations, and independent verification**

Progress in building CSCS | Lifecycle emission reduction



Address the three typical pain points of relying on a single overseas database

Technical representativeness	Geographical representativeness	Temporal representativeness
Lack of accurate representation of China-specific technologies and processes	Lack of accurate representation of China's energy structure	Lack of timeliness

Both CLCD and ecoinvent are officially recommended lifecycle databases under the GHG Protocol

Progress in building CSCS | Chain of custody

Proof of sustainability

Records the quantity, origin and handover information of each stage - procurement, warehousing, delivery and batch transfer, serving as the primary basis for certification data.

Traditional transfer method

- Each stage is completed and signed off manually via physical documents
- Cross-stage and cross-entity traceability depends on the handover and retrieval of physical documents

CSCS approach

- Blockchain technology rebuilds the chain of custody, replacing the traditional paper-based Proof of Sustainability (PoS) document flow
- Data from all stages - warehousing, delivery and transfer - are entered into the system online in real time

Progress in building CSCS | Social and economic sustainability safeguard

Social sustainability indicators

Labour rights
- Establish and implement dedicated management systems to fully protect labour rights

Water use
- Adopt water-saving production methods and establish water-saving management systems
- Applicable technologies: separated water supply, high-efficiency cooling and washing, water recycling, wastewater treatment and reuse

Land use
- Develop and operate in strict compliance with land classification requirements
- Comply with land use right agreements and urban planning requirements

Food supply security
- Feedstock selection principle: no competition with food for land, no competition with people for food

Economic sustainability indicators

Economic development
- Drives local tax revenue growth and local employment
- Promotes the optimisation and upgrading of the regional industrial structure
- Supports the low-carbon transition of industry

- **CSCS Checklist covers all the above indicators and serves as the unified reference for on-site audits by certification bodies**

Progress in building CSCS | Auditors and certification bodies qualification

Auditor requirements

- Bachelor's degree or above; meets the competence requirements of ISO/IEC 17021-1, ISO/IEC 17065 and ISO 14064-3
- Relevant professional knowledge plus 3+ years of work experience
- Completed initial training and mastered the applicable requirements of the sustainability certification scheme
- Formally employed by one certification body
- No record of illegal or non-compliant practice

Certification body requirements

- A legal entity able to independently bear full certification responsibility
- Registered capital of no less than RMB 30 million and good credit standing in the past 3 years
- Holds the required accreditation certificates and a management system compliant with CSCS
- At least 3 qualified auditors plus 1 responsible manager
- Experiences in sustainability certification or related ISO auditing

- **Effectively mitigates systemic risks: lack of competence, conflict of interest and unassigned responsibility**

Progress in building CSCS | Application & validation

01 Objects

Manuals, Procedures, Checklists, Tech Docs, Tools, etc.

02 Scenarios

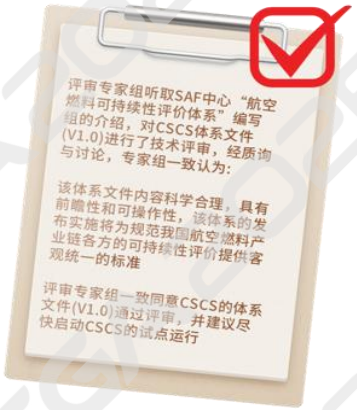
Feedstock supplier, feedstock processor, fuel manufacturer, fuel supplier, trader, etc.

03 Improvements

Revise the impractical parts and improve SCS continuously.

- Effectively ensures the practical applicability of CSCS

Progress in building CSCS | Pilot application



体系文件通过评审

System Documents Pass the Review



现场试运行

On-site Pilot Operation



- Jul 2025: Successfully passed a joint review by 27 industry experts.
- Close beta test: Engaged 13 Chinese SAF value-chain companies, enabling sustainability audits, life-cycle emissions accounting, and end-to-end data exchange.
- System integration: Connected with China National Aviation Fuel LTD's smart fuel management system.
- Pilot applications: Applied in the Spark Project's Scope 3 environmental attributes initiative and the Beijing Changping Model for SAF commercialization in Beijing.
- Sep 2026: CSCS has already passed an expert review organized by the CAAC — and gave it a very positive response across the board.

Successfully completed end-to-end process testing, including full-chain information exchange, traceability, and simulated certification. **The system is ready for pilot operation**

03 Summary

Sustainability Certification | Summary

CSCS approach

Key takeaways: The CSCS scheme has made significant progress: it meets the internationally accepted requirements for sustainability certification, while at the same time reflecting China's specific conditions.

Enhancing the framework: Further research will be carried out on technical standards for new conversion pathways, including FT, ATJ and PTL. The list of approved feedstocks will be continuously iterated and expanded to cover a broader range of feedstocks aligned with China's resource endowment.

International recognition: Building on the operational experience and outcomes accumulated through our indigenous sustainability assessment system, we will explore arrangements for bilateral or multilateral mutual recognition.

Together we shape the future of Sustainable Aviation

Scan and follow-up
SAF center