



# Aviation Alternative Fuels Practical Deployment Hurdles

John Lo

ICAO Aviation and  
Sustainable Alternative Fuels  
Workshop

Montreal, October, 2011

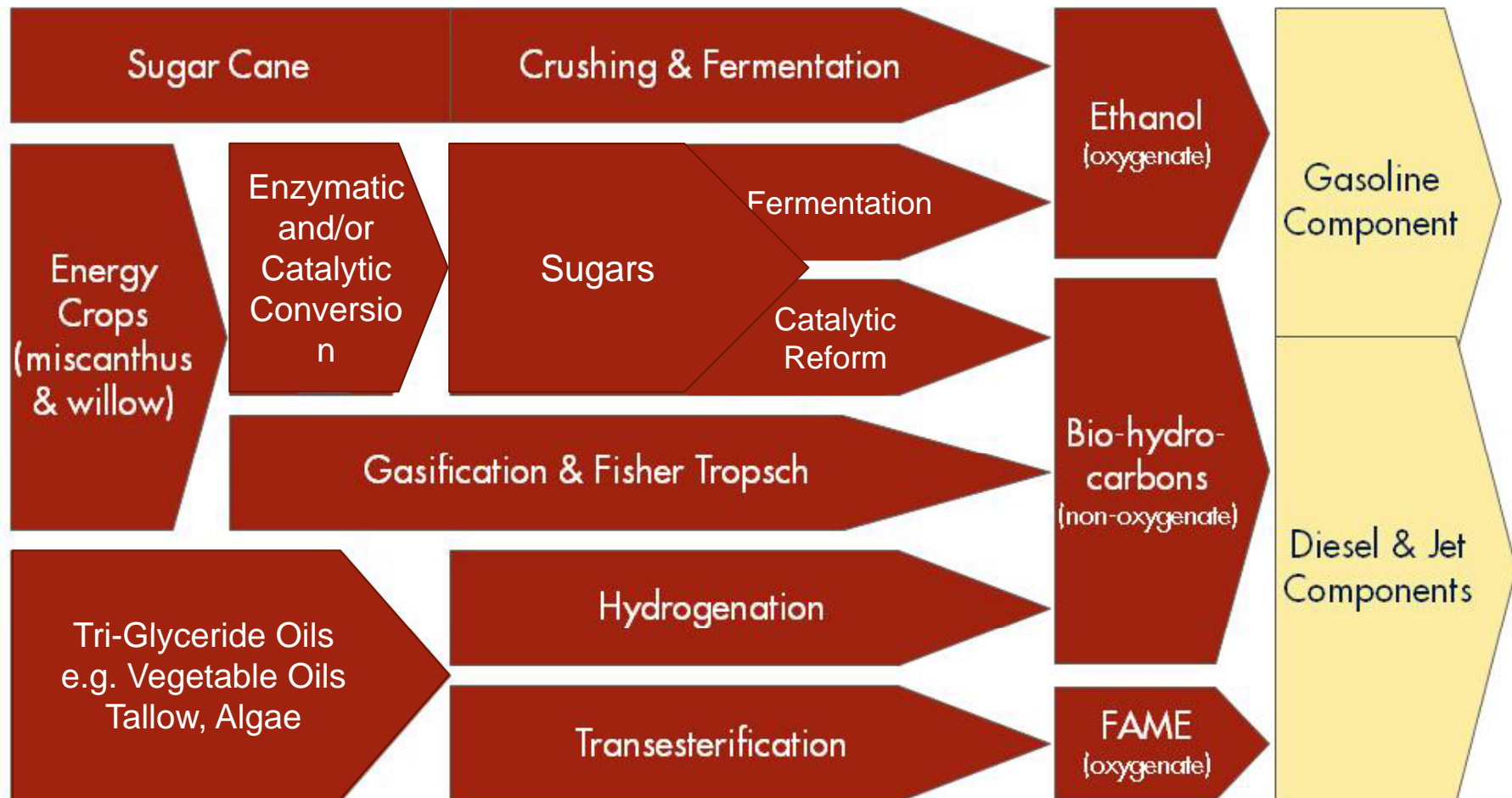


Shell Aviation  
SIPC Ltd

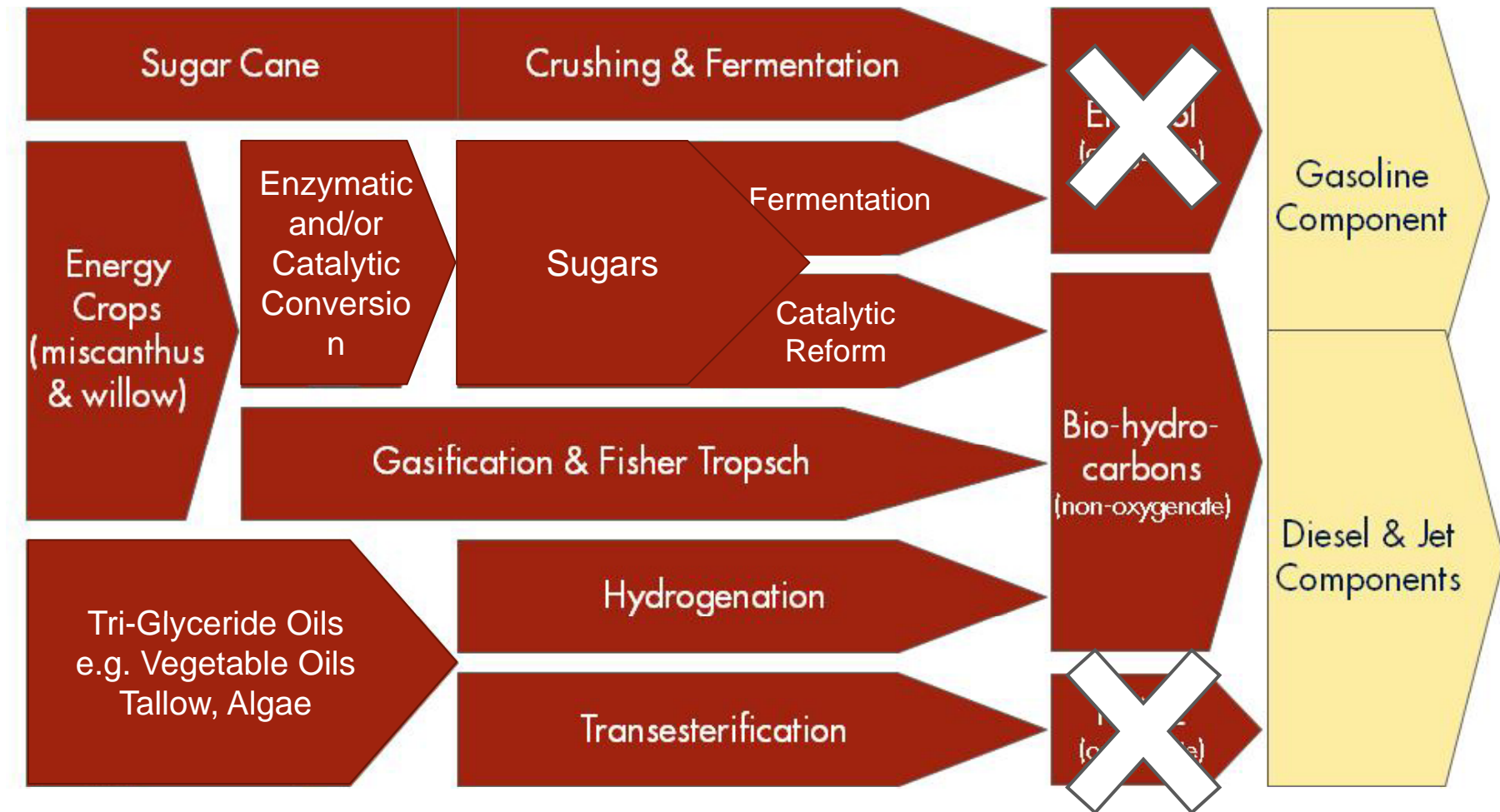
# Overview

- **Biofuel options**
- **A new supply chain**
- **Product quality assurance**
- **Summary**

# Pathways for renewable fuels – all options

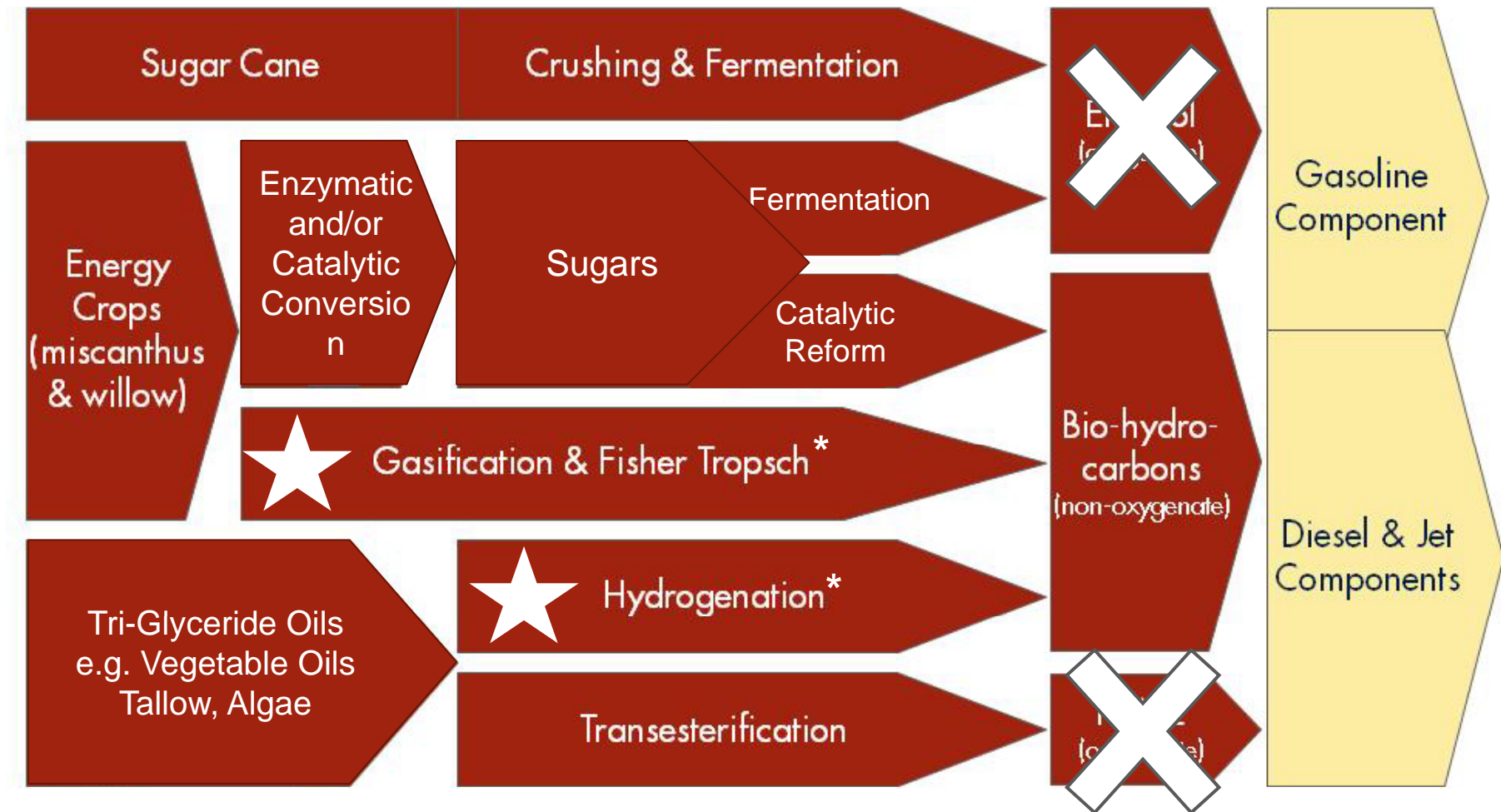


# Pathways for renewable jet fuels – oxygenates are out!



# Pathways for renewable jet fuels – approved processes

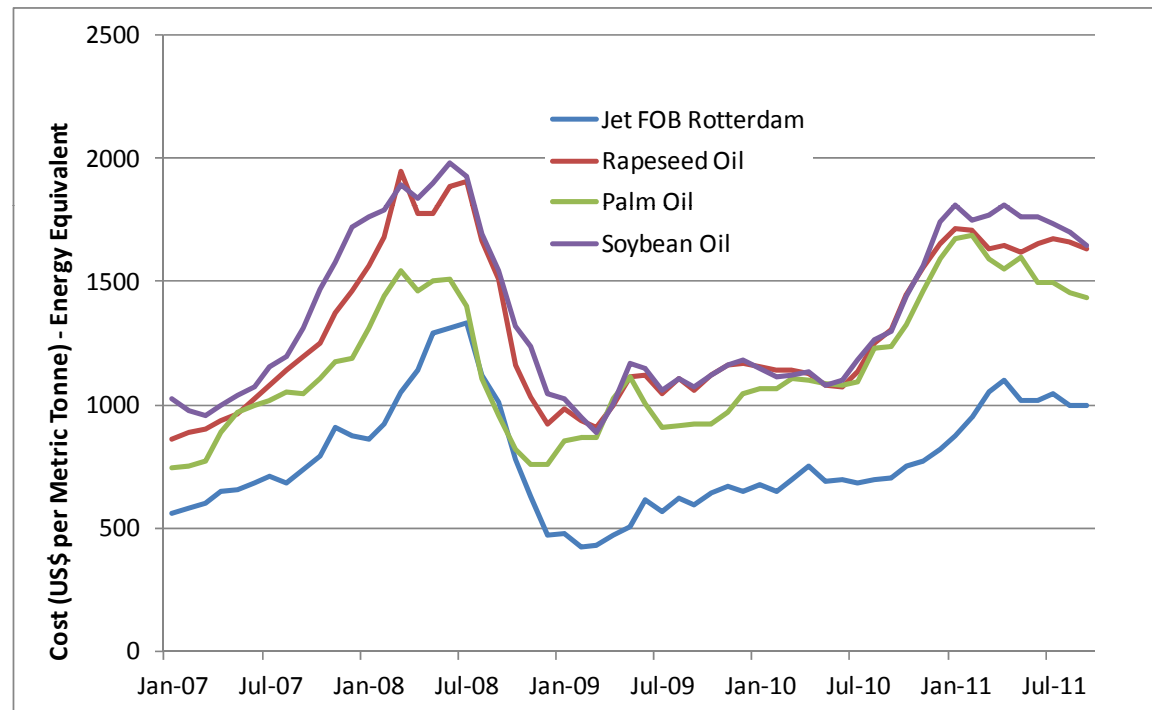
BTL AND HEFA ARE APPROVED BUT MORE OPTIONS ARE NEEDED



## HEFAs are a possible solution for the near term...

But, they are not a cheap source of energy and limited by supply constraints

- Competition with biodiesel mandates
- Lower yields for jet cut vs diesel
- Higher cost and limited supply (only 2m tonnes in production)
- Sustainability concerns (land use change) and limited (RSPO, ISCC) supply available



## There are other realistic routes to bio-hydrocarbons

- The Virent sugar-to-hydrocarbon process produces bio-gasoline - allows the Ferrari F1 race fuel to meet mandatory 5.75% bio content without oxygenates

- No pit-stop rule means that energy density of fuel in F1 is critical – just as it is with aviation

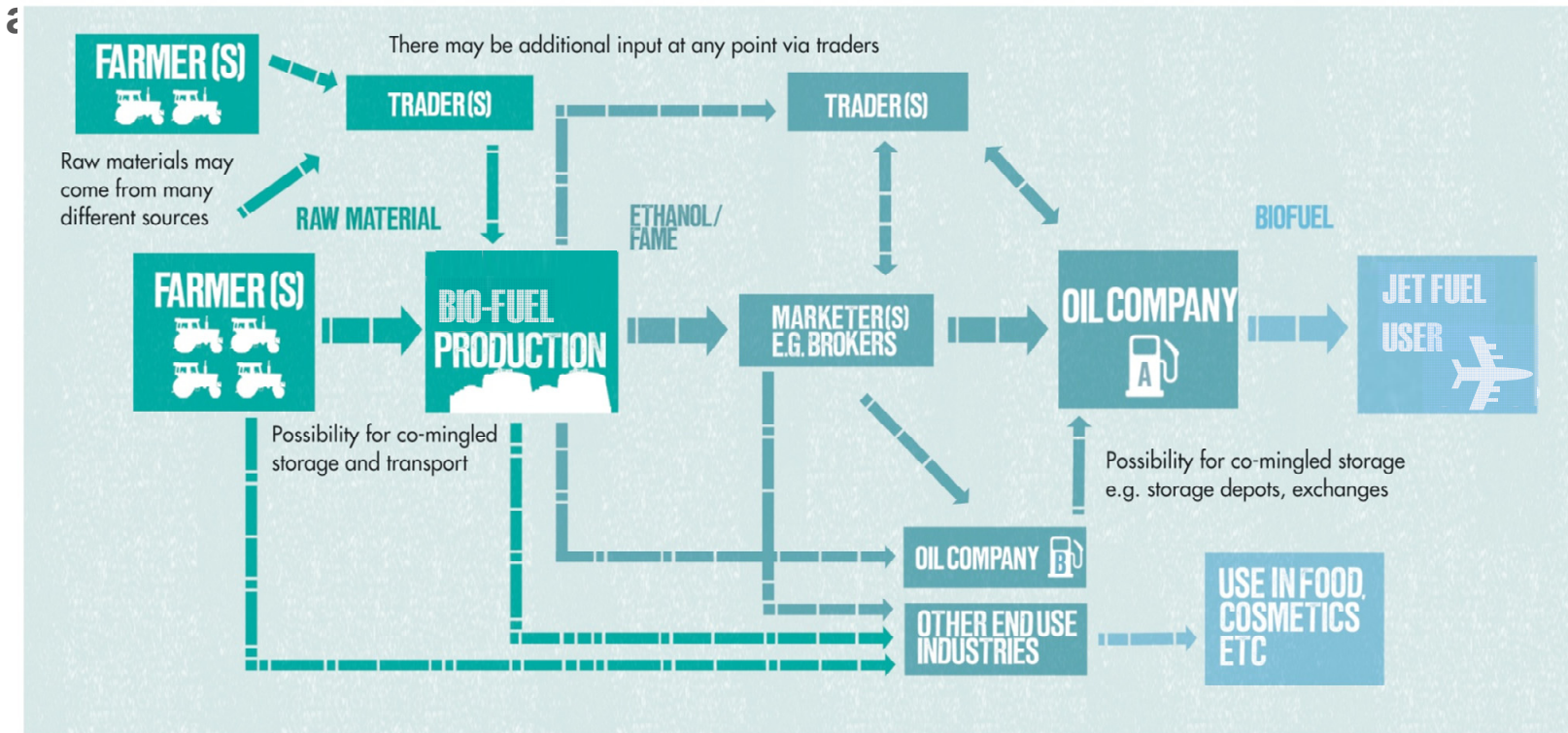


- This process (Aqueous Phase Reforming) is proven for gasoline molecules, now being further developed for middle-distillates with Shell as an equity investor and technical collaborator



# Ensuring sustainability is not simple

Biofuels supply chain is complex and sustainability must be traceable and



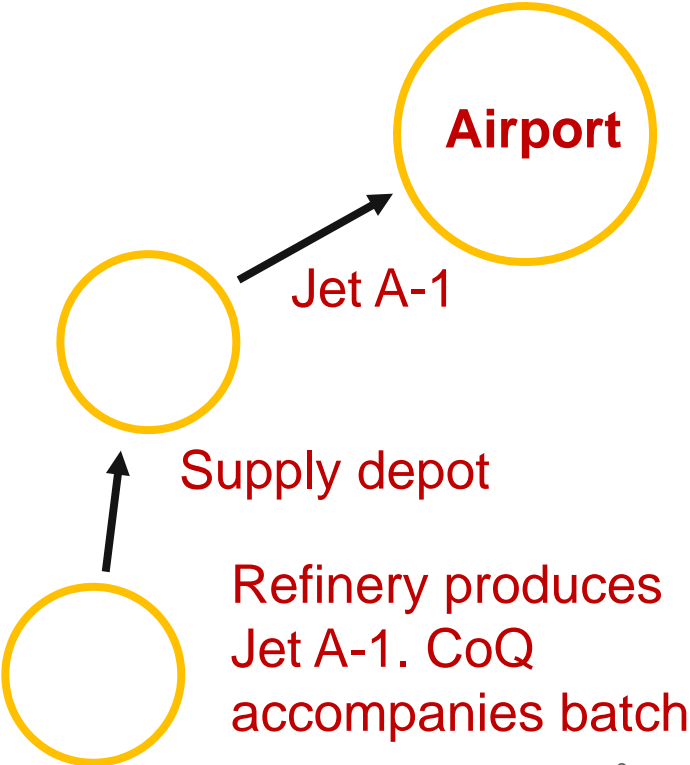
## Sustainability principles and criteria need to include:

- Responsible business practices, labour conditions, and community relations
- Responsible environmental practices, soil and water management, crop and biodiversity protection, and establishment of new plantations/operations
- Shell is taking an active role in several multi-stakeholder forums e.g. RSPO, RSB,

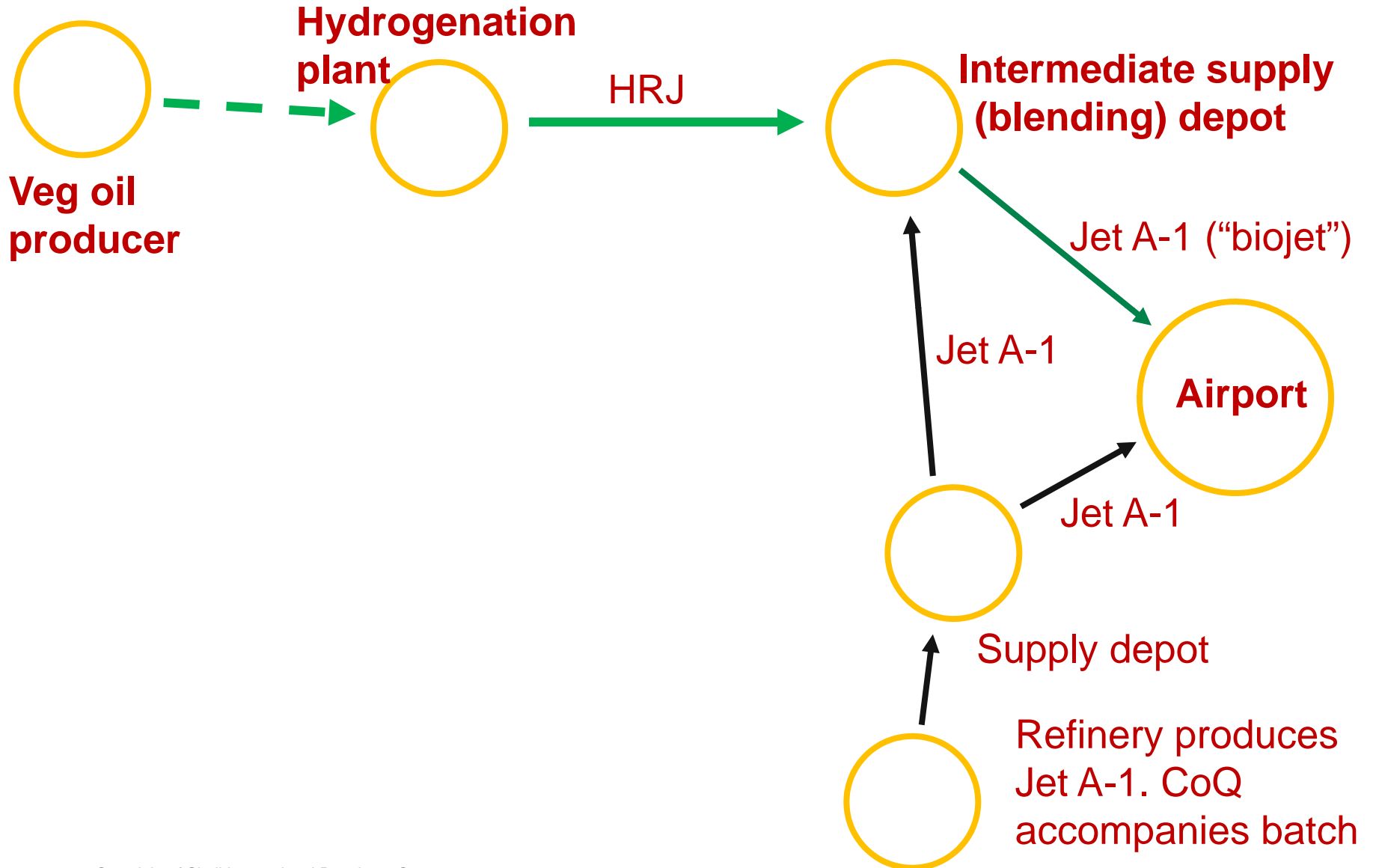
Bonsucro



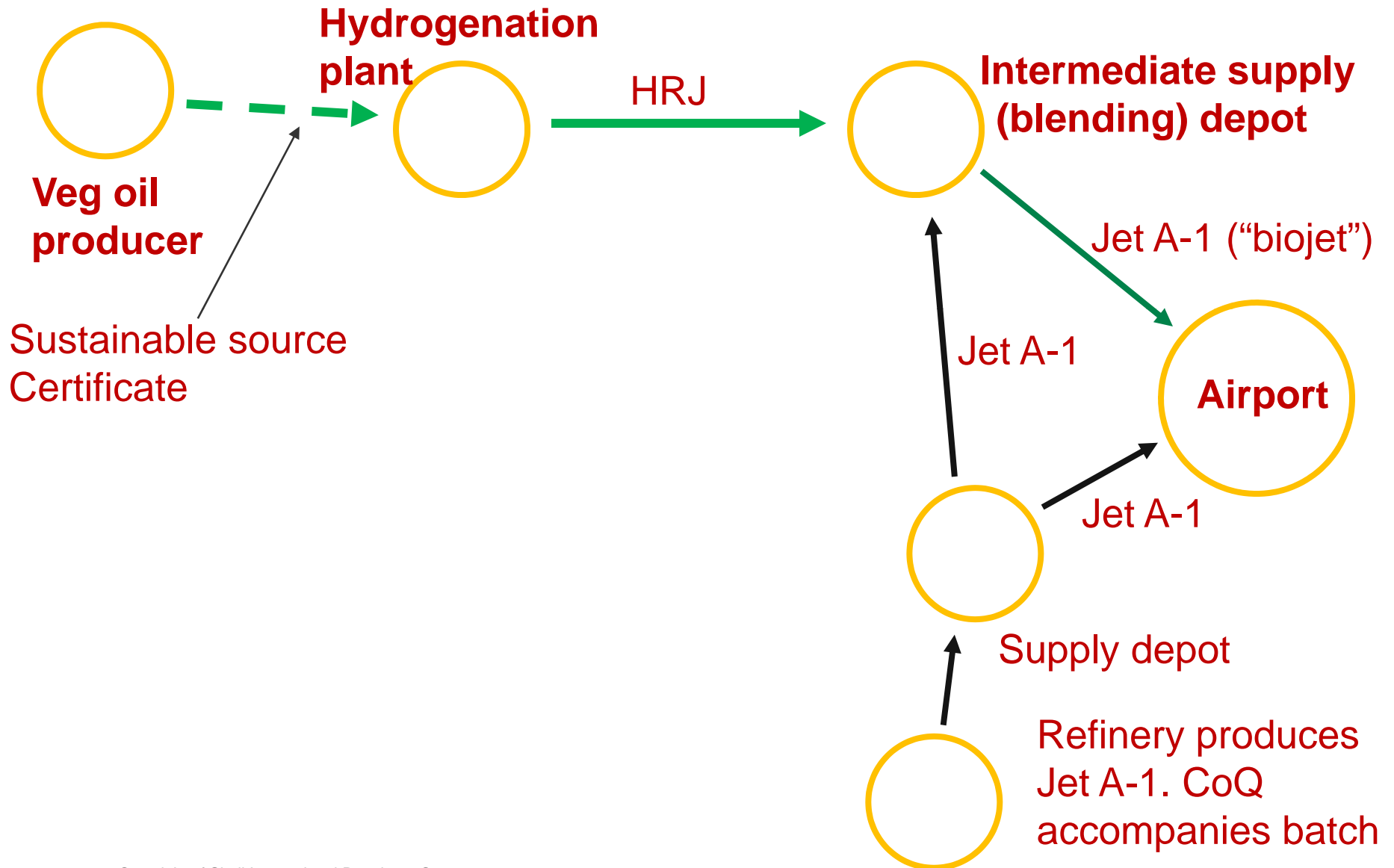
# Product quality assurance is also a key requirement



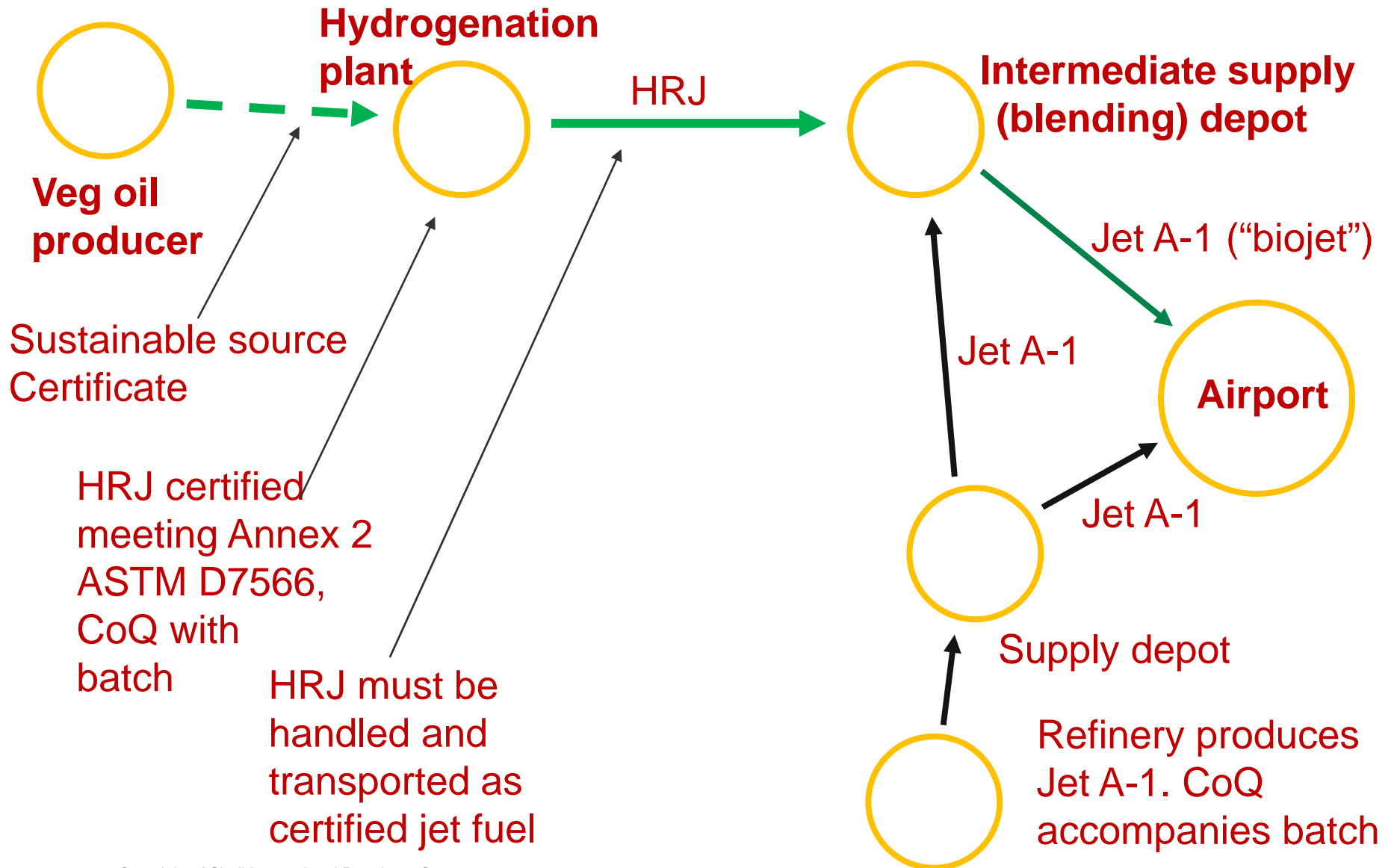
# Product quality assurance is also a key requirement



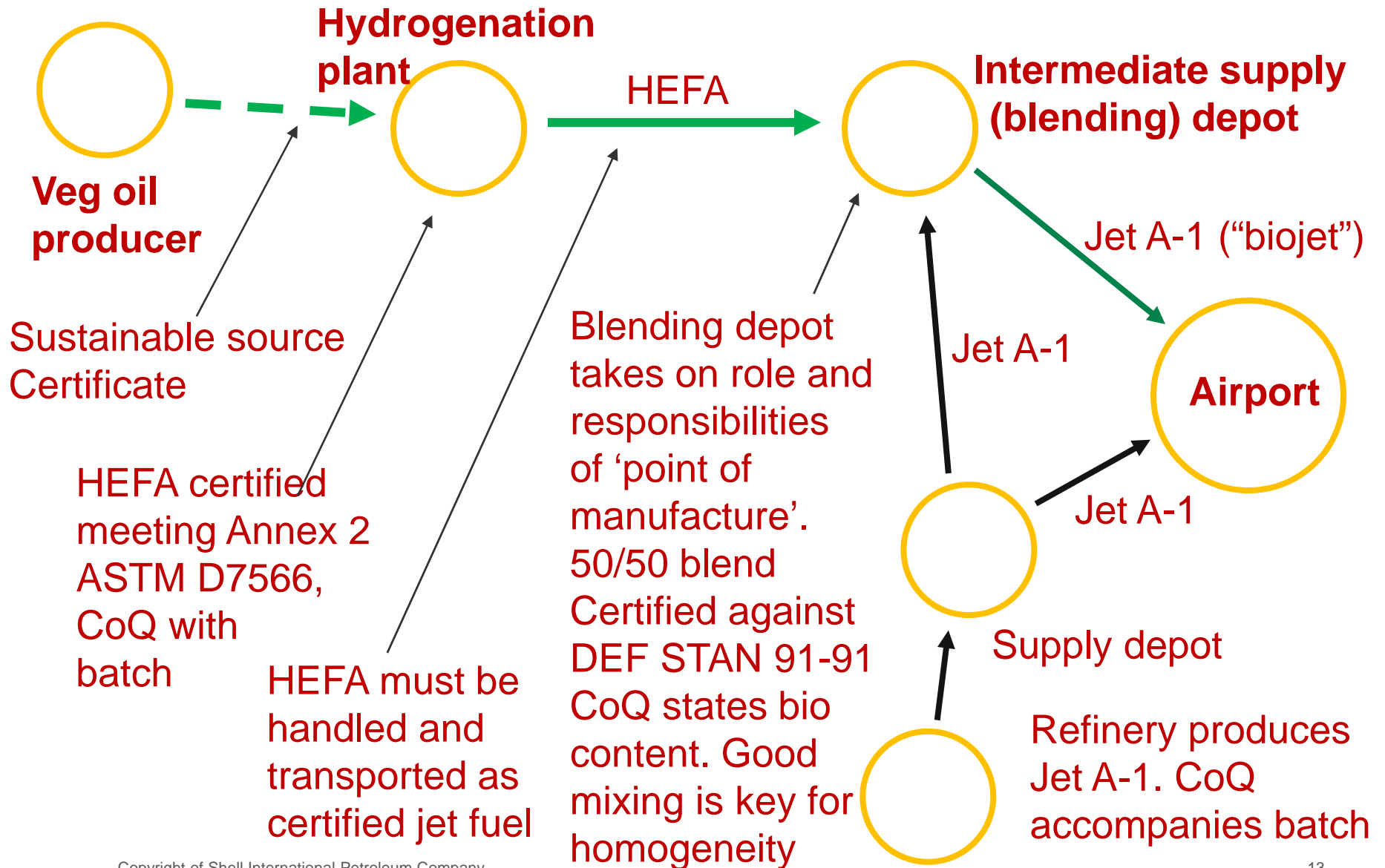
# Product quality assurance is also a key requirement



# Product quality assurance is also a key requirement



# Product quality assurance is also a key requirement





## There are still plenty of challenges

- Segregation of biojet at large airports likely to be difficult or impossible
- Airlines will find it difficult to actually burn their own bio-derived molecules
- Accounting and recording procedures (eg for EU ETS) will need to work in a fungible system.
- Some terminology in the specifications such as Refinery Certificate of Quality is confusing when applied to biofuels. Need more clarity on the relevance of Certificate of Quality, Certificate of Conformance etc.
- Specification groups eg ASTM, UK DEF STAN and JIG working on improvements and clarifications.

## Summary

- Although volumes will be low initially, the industry has made a fantastic response to the CO<sub>2</sub> challenge
- Likely to be several feedstock/process combinations – no obvious single solution that is most cost-effective for airline customers at the moment. Longer term, biomass and waste are likely to be better feedstock options?
- Assuring quality (and sustainability) in new supply chains will be essential with ongoing need to fine tune QA for the new world
- New tracking and auditing schemes needed for recording biojet use and associated CO<sub>2</sub> credits
- Aviation is not the only game in town, what will drive bio hydrocarbons into aviation?