

The Challenges of Implementation & Deployment of Alternative Fuels

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Some Definitions

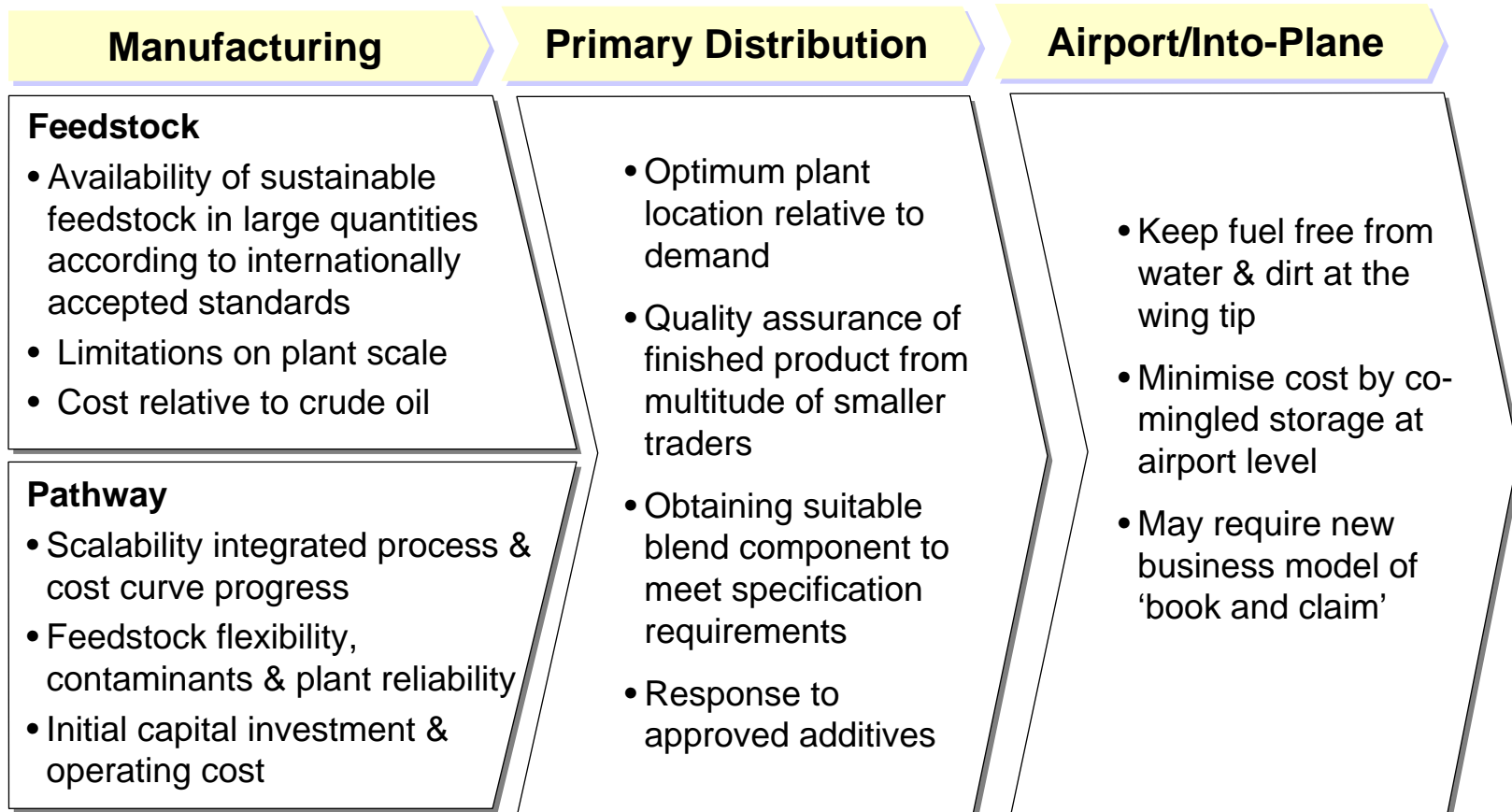
Alternative Fuels:

- Typically any fuel not derived from traditional crude oil refining and not currently approved to ASTM-D-1655 or DEFSTAN 91-91 specifications

'Drop In' Fuels

- Fuels that require no modification to engine or airframe hardware and can be co-mingled with conventional kerosene fuels without compromising any of the key fuel characteristics
- This explicitly excludes oxygenate fuels (e.g. Ethanol or Methyl Esters) due to known drawbacks in energy density & freezepoint) or Liquid Hydrogen due to extremely challenging handling

Significant challenges throughout the supply chain



The key issues remain:

- Uncertain returns against huge investments
- Competition with other transport fuels where incentives or penalties already exist
- Availability of certified sustainable feedstock in sufficient quantities and competitive cost
- Technology readiness level of most promising pathways
- Unrealistic expectations on short term success and large scale availability

Despite all of these issues, work continues as Aviation's long term need for a liquid hydrocarbon solution remains compelling...