Cost Management of Bio Jet Fuel in Japan

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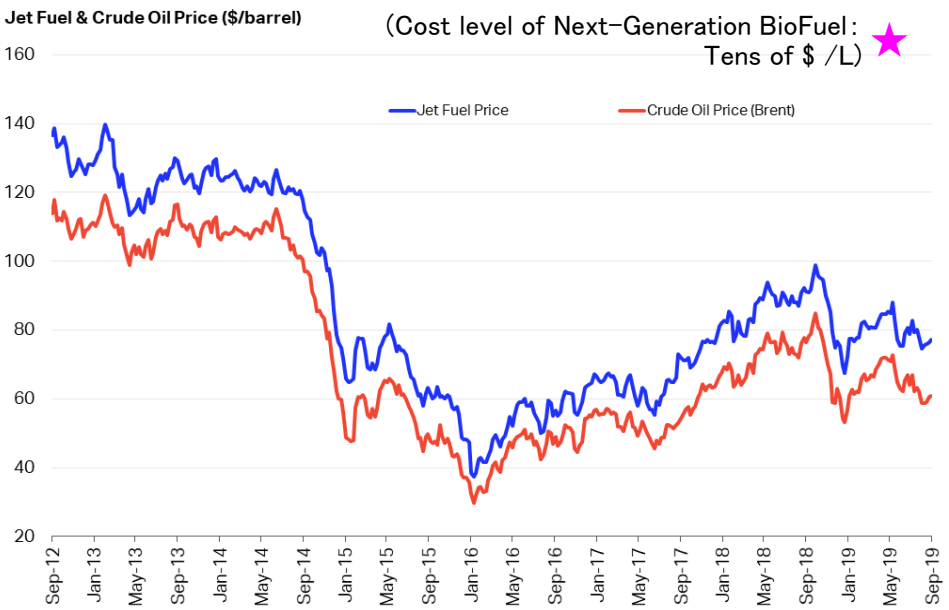
Background

- Globally, Bio Jet Fuel (BJF) production is based on a variety of manufacturing methods (according to ASTM7566-ANX) which correspond to various feedstock. Some have achieved large-scale production in advance, some have reached the lab level demonstration. Although the difference of manufacturing costs is still wide, either way, it's more expensive than Fossil Jet Fuel to be estimated (underestimation).

- In Japan, the domestic production and supply capacity is required for BJF from the viewpoint of Energy Security and Industrial Promotion, moreover the gap of production cost with imported BioFuel must be reduced.

- Since there is big difference of the price between current BJF and Fossil Fuels (kerosene = cheap), commercialization cost requires a significant reduction.

<JET-A1/Kerosene Price transition table>

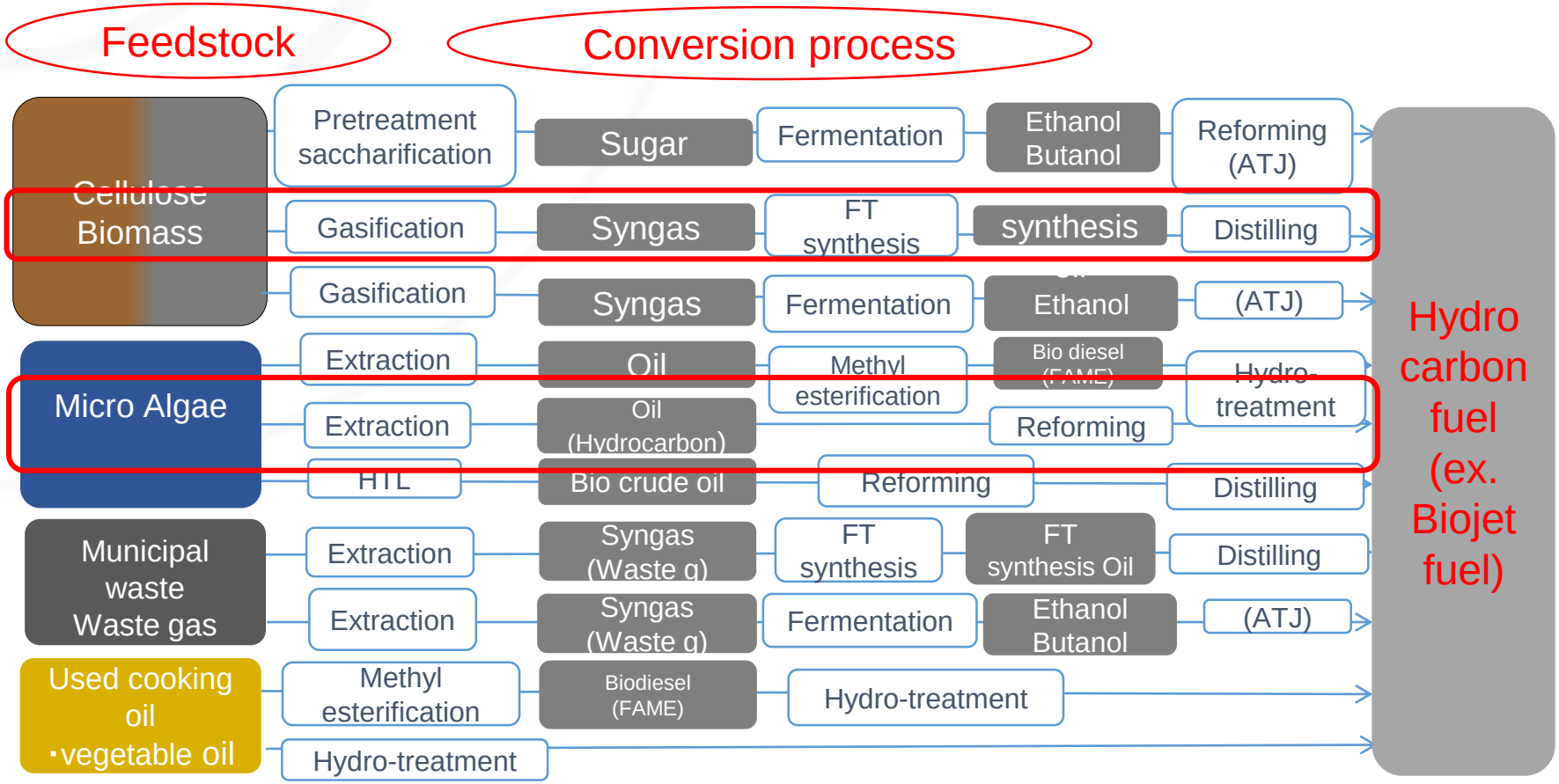


Source: Platts, Datastream

IATA H/P : Jet Fuel Price Monitor

R&D of Hydrocarbon Fuel

There are varieties of feedstocks and conversion processes.
NEDO's National projects are development of integrated manufacturing technology for Gasification & FT synthesis process and MicroAlgae process.



NEDO's Biomass Energy Project

NEDO R&D Projects for Biomass

Alternative Fuel for Transportation

BioEthanol

Base technology development for non-edible plant-derived BioEthanol (FY2007-FY2012)

Development of efficient elemental technologies for BioFuel production (FY2013-Y2016)

Project to develop integrated production system for Ethanol from non-edible plant (FY2009-FY2013)

Demonstration for integrated production system from Cellulosic Biomass (FY2014-FY2019)

Hydrocarbon Fuel(BioJet Fuel)

R&D projects about Algal BioFuels

Next-generation BioFuels development other than Ethanol (FY2010-FY2016)

Development of production technologies for BioJet Fuels (FY2017-FY2020)

Power Generation & Heat

Project to develop each installments such as gasification reactor (FY2001-FY2012)

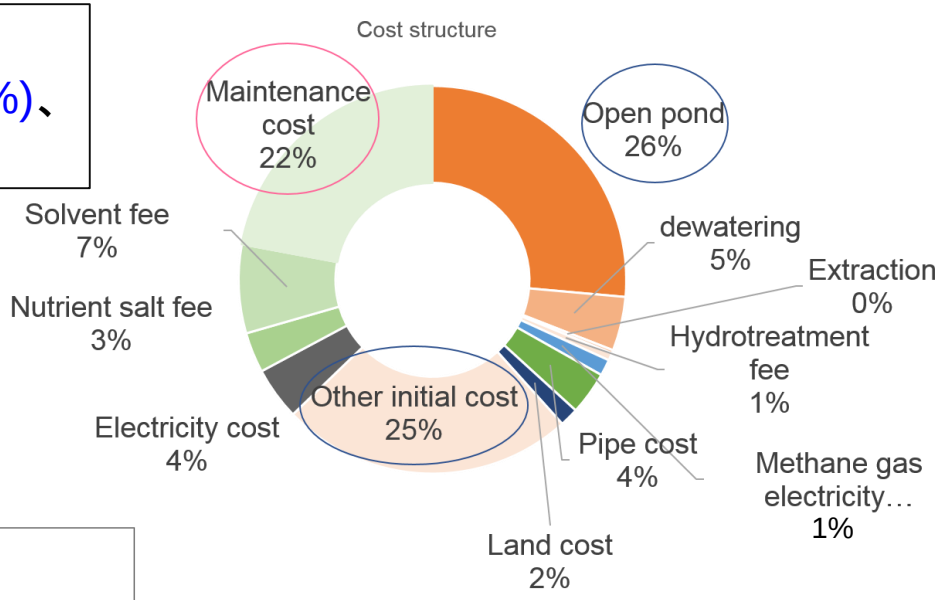
Demonstration Program for Locally Sustainable Bioenergy System (FY2014-FY2020)

FY2007 FY2010 FY2018 FY2020

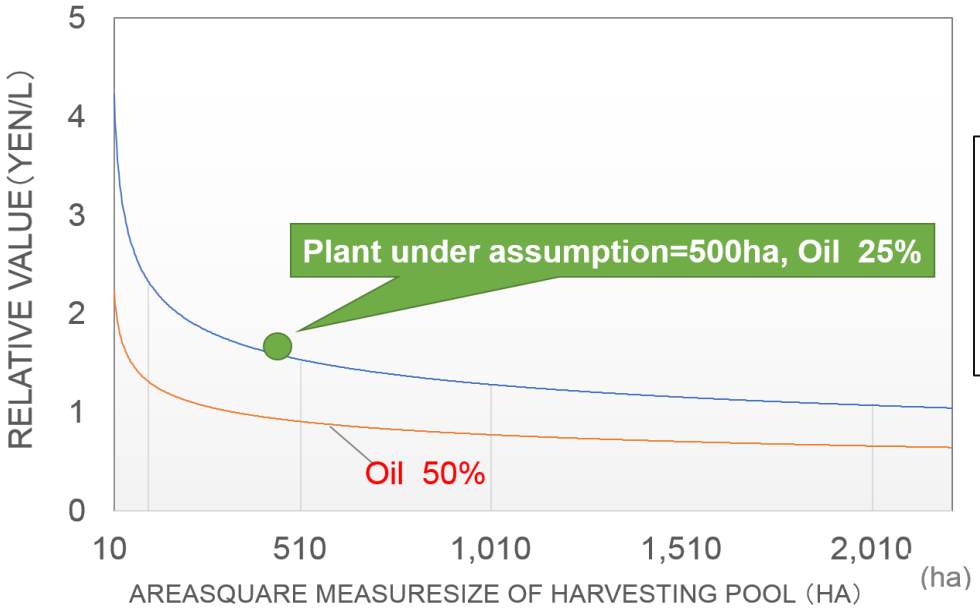
[Hydrocarbon fuel from micro algae model case]

- Facility and equipment cost is 50% (Open pond 26% and Initial cost 25%)、Maintenance cost is 20%.

Cost structure



Scale merit



- It takes more than 400ha to reduce cost in case of this model.
- The lager the amount of oil included in algae is, the cheaper fuel cost is.

Antinomy (trade-off, contradictory)

- Cost Management varies depending on the feedstock (=ASTM ANX).
- In general, mass production of BJF contributes to cost reduction by improving production efficiency.

  [Cellulose Biomass-Gasification & FT Synthesis] :

  ⇒ Scaleup of Gasifier & FT Reactor, Aggregation of storage depo

  [MicroAlgae] :

  ⇒ Upsizing of Culture pond for mass production, Aggregation of storage depo

  CapEx Expansion : Benefits of expanding production ＞ Disadvantage of OpEx expansion

- On the other hand, The following LISK is included in the enlargement

  [Cellulose Biomass-Gasification & FT Synthesis] :

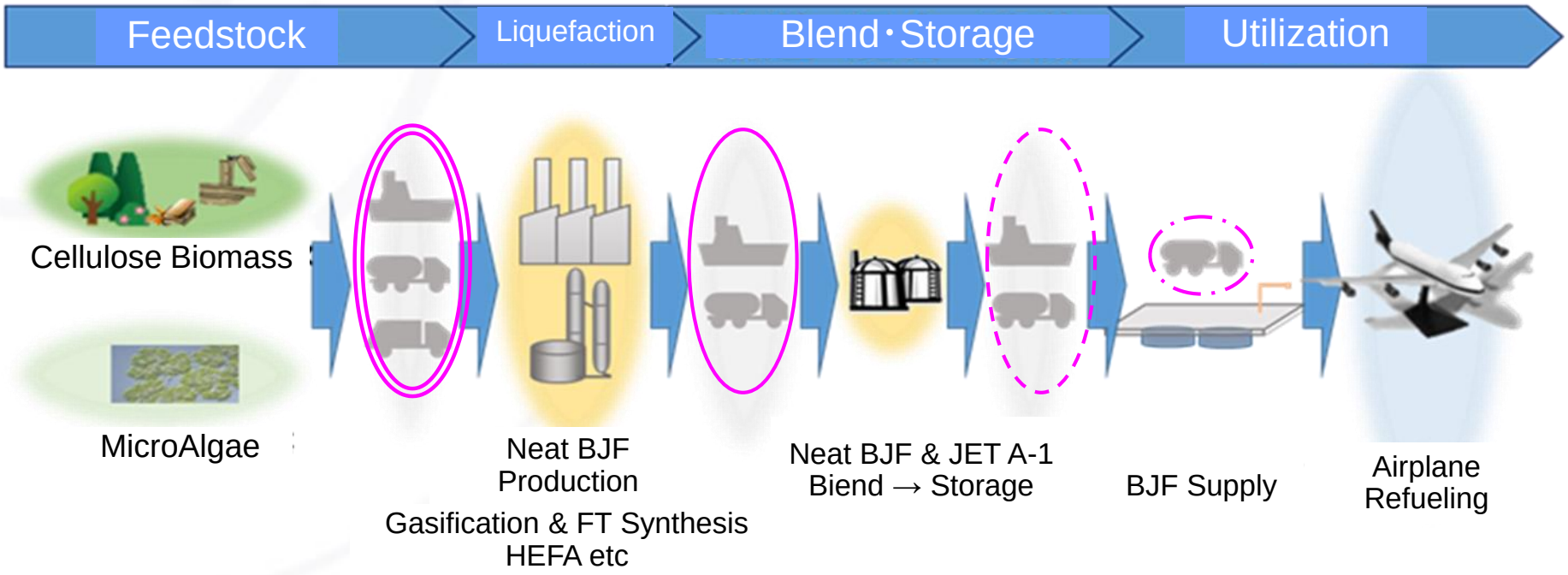
  ⇒ Increase in transportation costs for collecting feedstock due to large-scale procurement of raw material (Mountainous region), in the first place, the possibility of suitable procurement is a problem.

  [MicroAlgae] :

  ⇒ Poor growth due to contamination with bacteria at open-air

  CapEx Expansion : Benefits of expanding production ＜ Disadvantage of OpEx expansion

Antinomy (trade-off, contradictory)



- Increasing the size that is advantageous for commercialization, on the other hand, has the risk of becoming the antinomy/trade-off against the business concerns such as an increase in transportation costs for collecting feedstock and also reduced production quality and productivity.

Issues for current study

- To reducing the environmental impact, It is necessary to consider decentralizing the installation depo to avoid the excessive transportation cost caused by aggregation.

  Around Metropolitan International Airport = CapEx Intensive(Upsizing)

  Around Regional Airport = Distributed

- Feedstock liberalization concept and quality improvement

  [Cellulose Biomass-Gasification & FT Synthesis] :

  Utilizing low-quality biomass such as forest scrap (bark / pruned branches, etc.), unused resources (wet cellulose), waste, etc., enables more stable and large-scale feed collection.

  [MicroAlgae] :

  If large-scale culture pond cannot be secured, it is also important to focus on high-density culture technology of algae itself.

- Effective use of by-products and recovery and use of production heat

- Scrutinized repeated verification by processes that can be implemented continuously, then by reviewing the conditions that are acceptable with Lab Tool, It becomes important to search for the Overall Optimization which includes Regional activation such as Local production for Local consumption in addition to costs, not for the Partial Optimization.