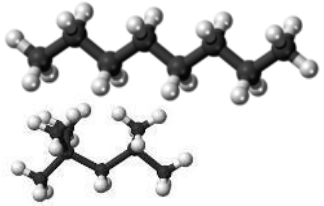
Low Carbon Vehicle Partnership Annual Conference, 8th July 2019
Neville Hargreaves

Altalto waste-to-jet-fuel project

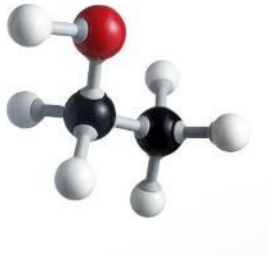
VELOCYS

Hydrocarbon fuels and alternatives

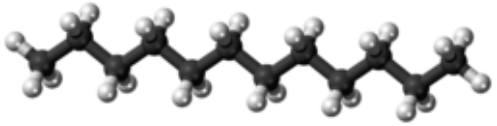
Petrol / gasoline



- 4-12 carbon atoms
- Substitute: ethanol from fermentation of sugars



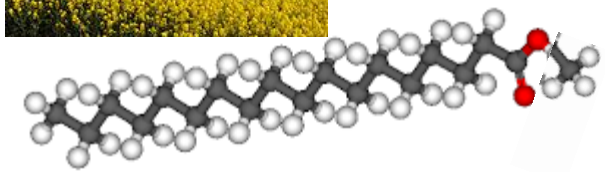
Jet fuel / kerosene



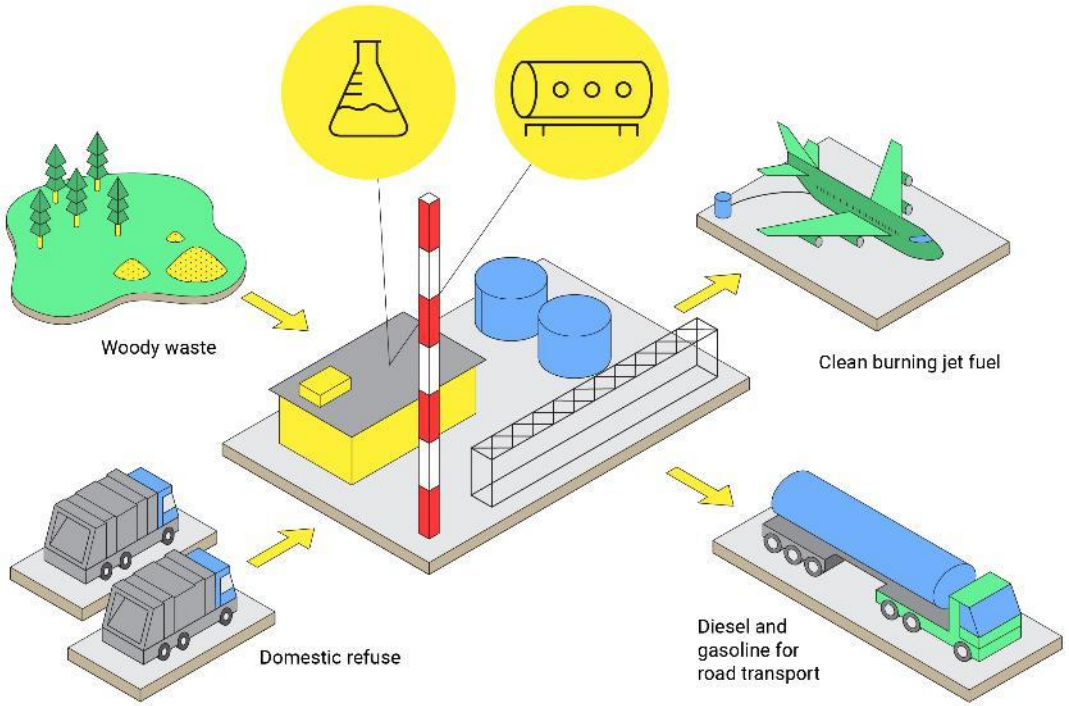
- 8-15 carbon atoms
- Substitute: needs to be essentially the same chemical substances
  - Energy density
  - Water shedding
  - Freeze point -47°C

Diesel

- 10-20 carbon atoms
- Substitute: fatty acid esters from vegetable (e.g. rapeseed) oils



Fischer Tropsch route to sustainable fuels



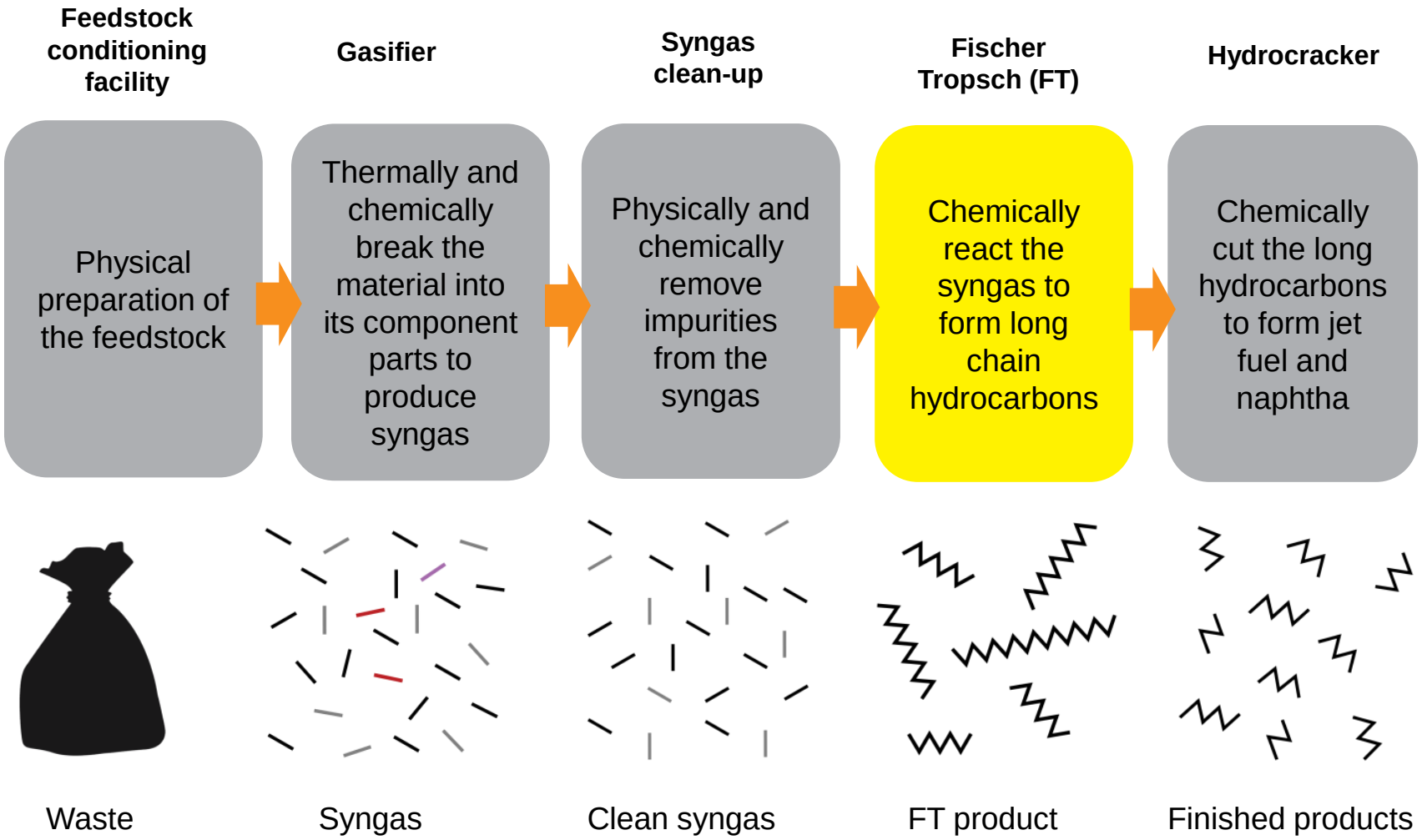
- Clean paraffinic fuel
  - 90% reduction in key exhaust pollutants (particulate matter, sulphur)
  - Approved at up to 50% in blend (ASTM D7566)
  - No changes to engines or infrastructure
- Greenhouse gas (GHG) reduction ~70%
  - Could be >100% with carbon capture
- Large resources of waste feedstock
  - Better (lower net GHG) way to dispose of residual waste than landfill or incineration

Product burns more cleanly than conventional fuel…

…as well as the greenhouse gas savings

Left: Diesel made using Velocys process; right: diesel from filling station

Process overview
Using established technologies



Velocys provides technology, integration and development

- Technology demonstrated at commercial scale
  - Reactor and catalyst for hydrocarbon synthesis (jet, diesel, naphtha)
- Combined with proven gasification, purification and hydrocracking technologies in end-to-end process
- Expert team with experience of designing, commissioning and operating synthetic fuel facilities
  - UK and US
- Traded on AIM (ticker: VLS)

ENVIA plant in Oklahoma City: commercial-scale demonstration of Velocys technology

ALTALTO

Project to build UK commercial waste-to-jet-fuel plant

BRITISH AIRWAYS

VELOCYS

60 million litres of clean drop-in fuel (for jet and petrol)

500,000 tonnes of residual waste saved from landfill

Site near Immingham

- Vacant land with industrial neighbours – earmarked for development under Local Plan
- Good transport and utility connections
- Energy Estuary renowned for fuels production expertise and highly skilled local workforce

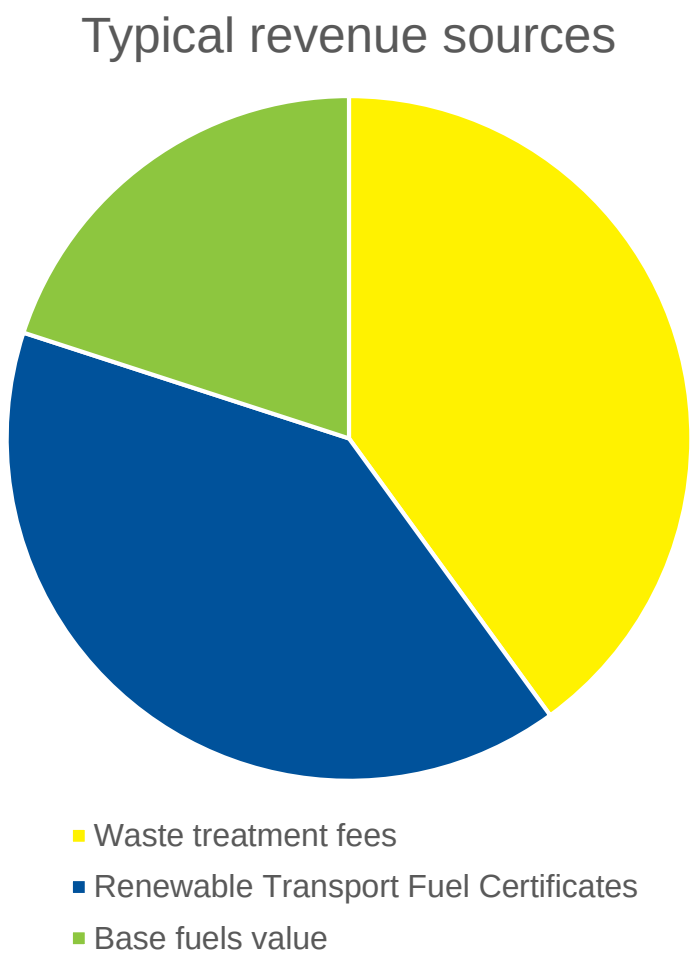
Project status

- £5 million invested in current stage including £434k F4C Stage One grant[1]
- Site selected, planning consultation in progress
- Plan to start construction 2021 subject to planning and funding

Model of plant on site near Immingham, North East Lincolnshire, UK

[1] F4C is the Future Fuels for Flight and Freight Competition, funded by the Department for Transport

Transport fuels policy key to early sustainable fuels plants



- In 2018, changes to Renewable Transport Fuel Obligation passed into law
  - Awards higher-value certificates for “Development Fuels”
  - Includes aviation fuel
  - For now, only credits in proportion to biogenic fraction of waste
- Combination of revenue streams required to make economics work

Summary

- Aviation is the most difficult transport sector for GHG reduction
  - Marine and heavy goods also challenging

- Fischer-Tropsch route gives:
  - 70% GHG reduction
  - 90% reduction in key exhaust pollutants
  - Better treatment of municipal waste

- Commercial project in development in Immingham with British Airways and Shell