

NOVA PANGAEA TECHNOLOGIES

SCALING UP SAF USING BIOMASS WASTE AS AN ENABLER TO DELIVER AVIATION NET ZERO

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WBA – ASFA WEBINAR

SUSTAINABLE AVIATION FUELS – WHAT WOULD IT TAKE FOR SAF TO TAKE OFF?

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AVIATION HAS COMMITTED TO ACHIEVING NET ZERO

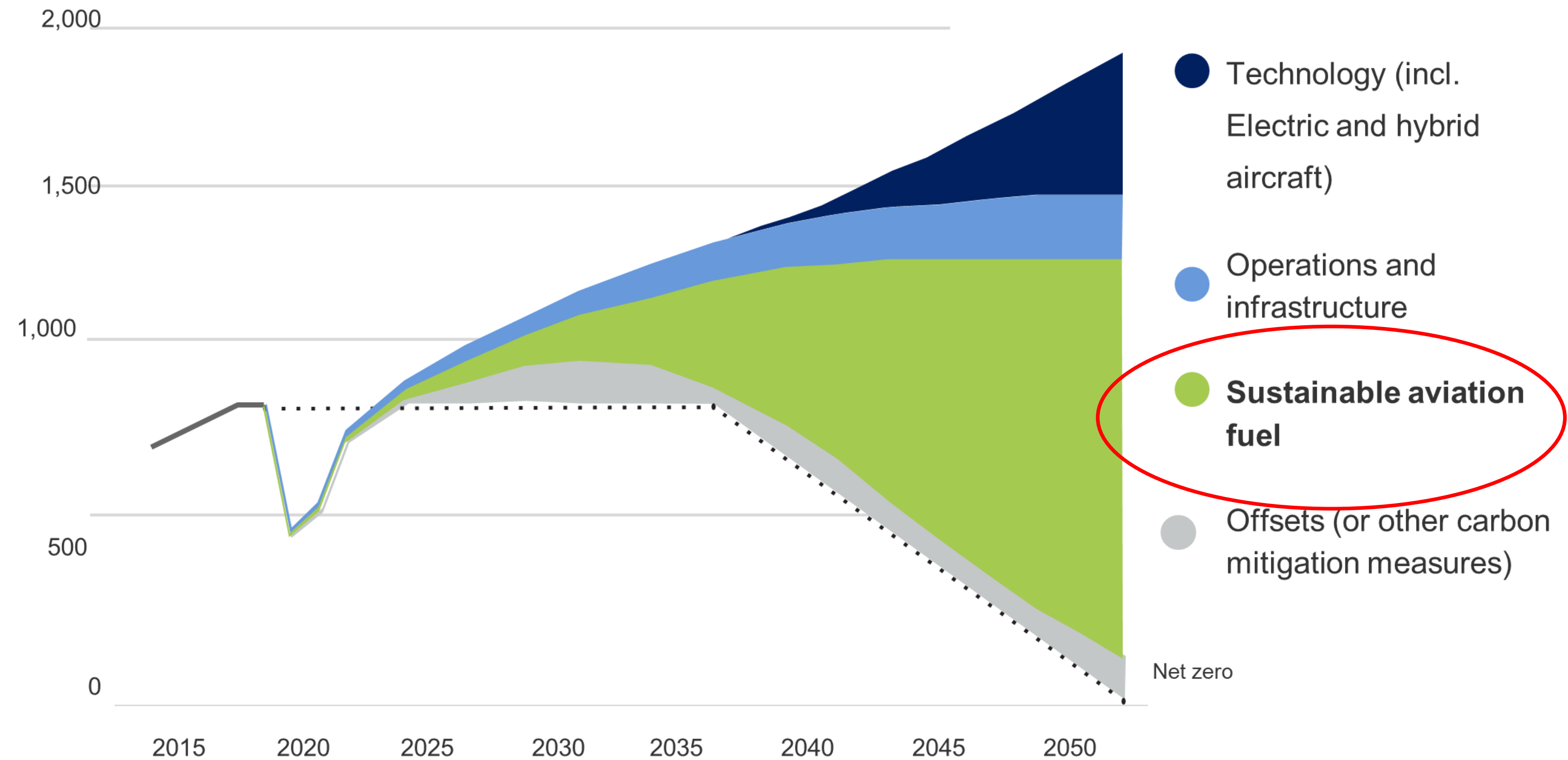
The growth opportunity for Asia is to build material supply of SAF with Alcohol to Jet technology using the plentiful supply of agricultural residues as low cost feedstock to make 2G cellulosic ethanol/SAF

- The market context & opportunity – aviation/SAF
- Nova Pangaea's technology solution – using biomass residues to make carbon negative ethanol/SAF
- Scaling up - the UK showcase project Speedbird

AVIATION HAS COMMITTED TO ACHIEVING NET ZERO

And using Sustainable Aviation Fuel is critical to achieve its 2050 targets

Aviation CO₂ emissions trajectory and reductions by measure (Mt CO₂e)



Governments, airlines and regulatory bodies have committed to Net Zero 2050

SAF will be the leading solution; as 'drop-in' fuel it used in existing aviation infrastructure

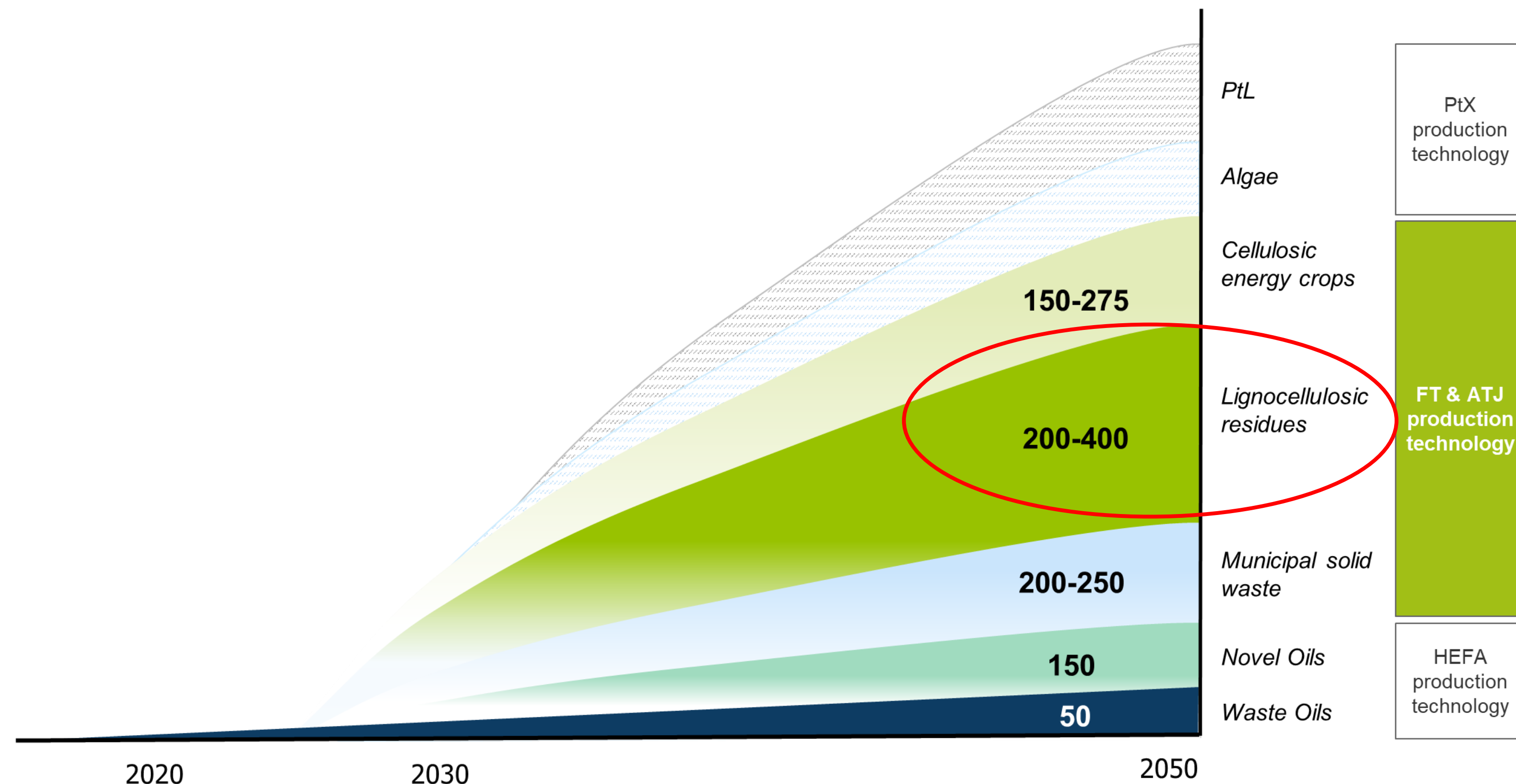
Electrification and Hydrogen fuel are nascent and are not expected to materially contribute to aviation net zero by 2050

1.8 billion tons p/a of carbon must be abated in the aviation sector by 2050 to achieve Net Zero

ADVANCED FUELS FROM BIOMASS RESIDUES ARE CRITICAL TO SCALING SAF DEMAND

Lignocellulosic feedstock-based production technologies are critical to scaling SAF long-term

Global raw material potential for renewable fuels (Mtoe)



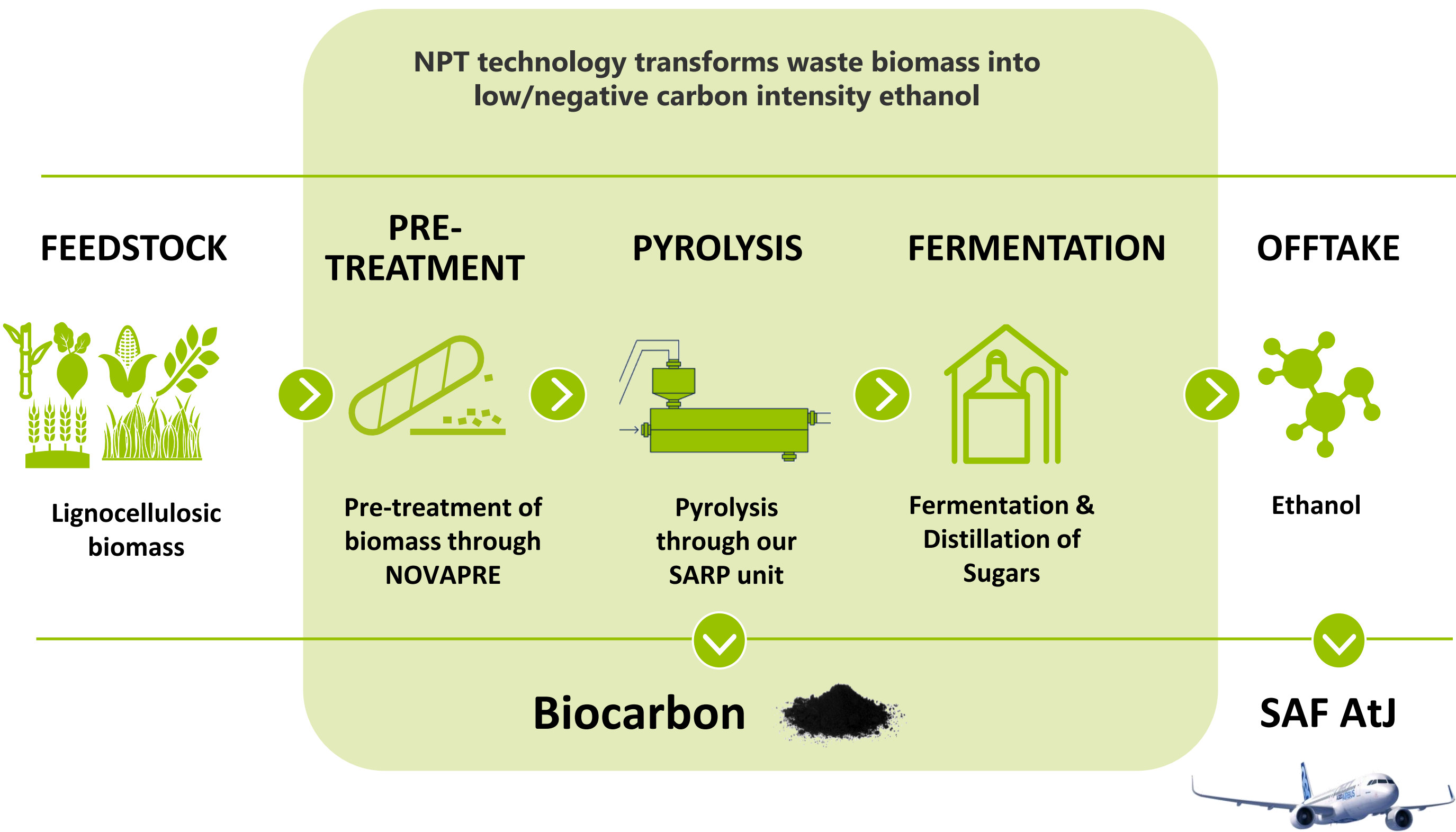
Lignocellulosic feedstock advantages

- Does not compete for food crops
- Does not require land-use change
- Uses biomass residue from existing agriculture and forestry processes
- Less risk of contaminants and variation compared to MSW
- Ready supply availability
- Additional source of income for rural/less developed farming communities

Source: Company analysis based on WEF Clean Skies for Tomorrow and other sources

REFNOVA®

REFNOVA® is a novel patented technology that simplifies ethanol production using heat alone to convert woody and agricultural plant residues into two distinct co-products: Sustainable sugars and Biocarbon



- ✓ *Simplified process that avoids the use of enzymes; high-profile industry failures have been due to enzyme requirement during pre-processing*
- ✓ *Secondary revenue stream through biocarbon; other technologies struggle to valorise lignin into a commercial product*
- ✓ *Greater emissions reduction potential than market competitors due to sequestration potential of biochar*
- ✓ *Feedstock flexibility, with ability to process multiple types of lignocellulosic residue*
- ✓ *Progressing with Technical Readiness: >500 operating hours of our patented SARP® unit and >1000 on our pre-treatment units*
- ✓ *Scale 'up' then 'out' through modular, in-line process, significantly reducing scale risk and time to market*

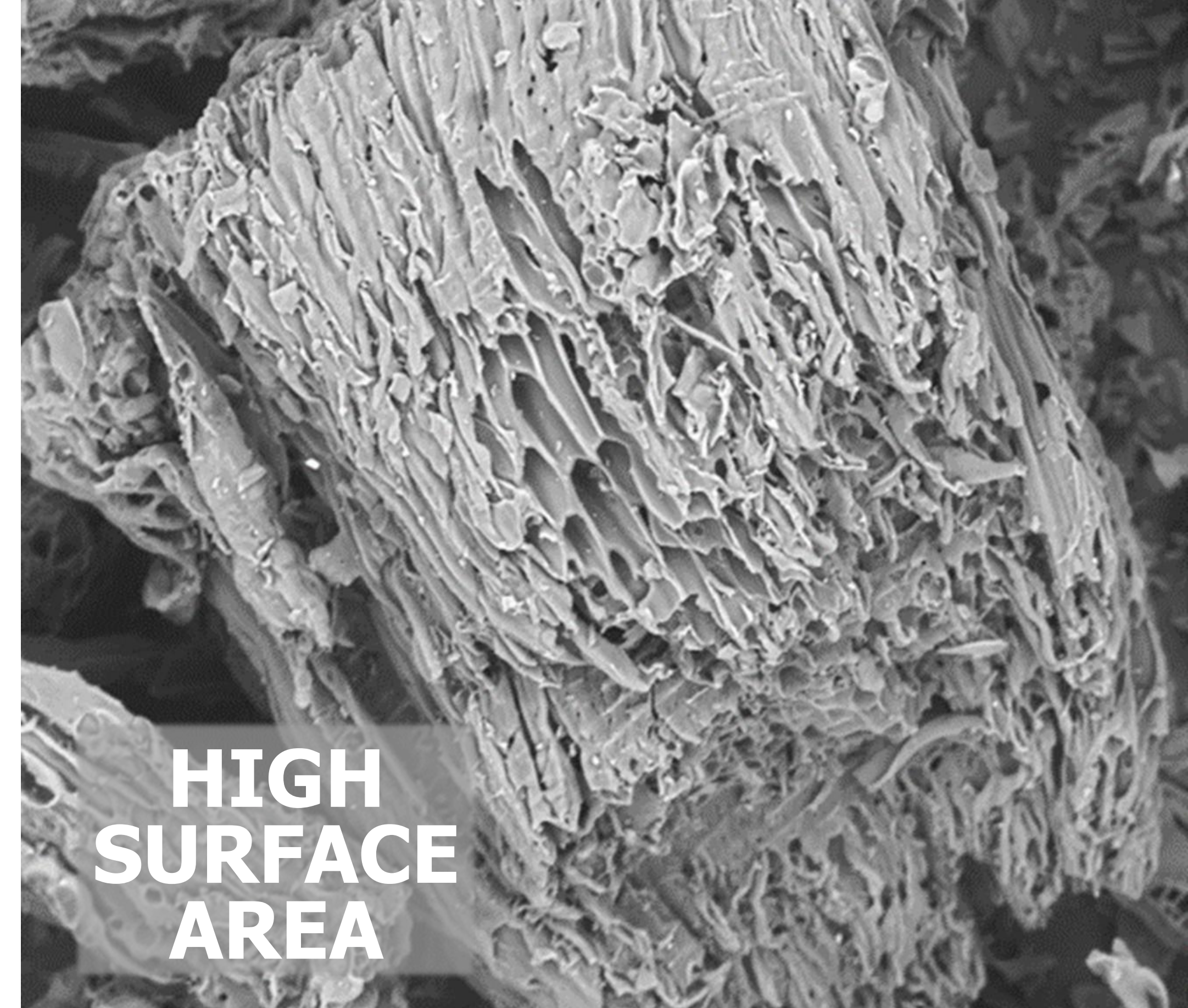
BIOCARBON

NPT's REFNOVA® process technology produces Biocarbon as a co-product alongside the cellulosic 2G ethanol. This Biocarbon has many applications as well as being a form of CO₂ sequestration

1 tonne of carbon in **NOVACHAR** = 3.6 tonnes CO₂ (before process emissions)

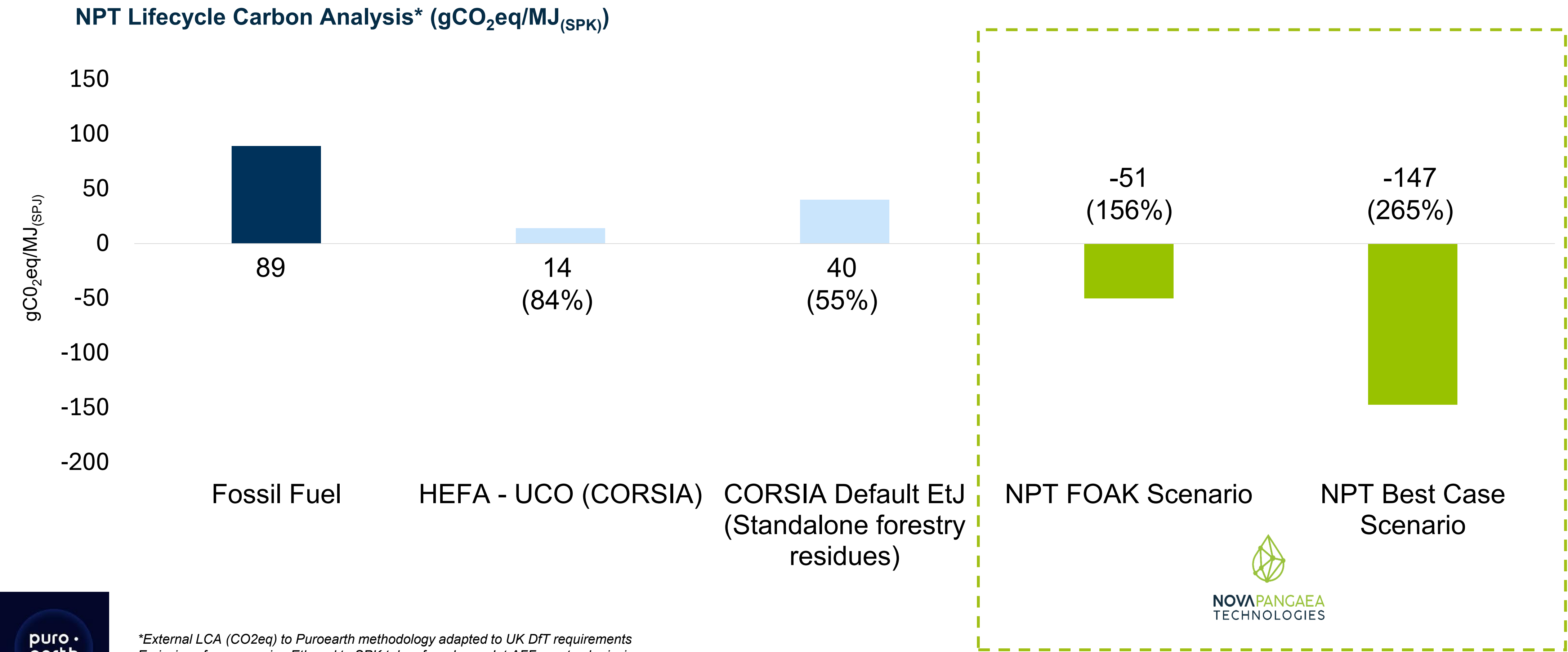
CARBON REMAINS FIXED – CO₂ is sequestered – **Net negative**

- **Soil enhancement**
Water retention and reduced fertiliser use
- **Filtration**
Water and air purification
- **As a filler in construction**
Cement and asphalt
- **Plastics and industrial applications**
As a filler/ colourant/ improved mechanical strength



REFNOVA® PROCESS HAS A NET NEGATIVE CARBON INTENSITY

The *net negative emissions* which can be monetised through SAF, or via carbon credits



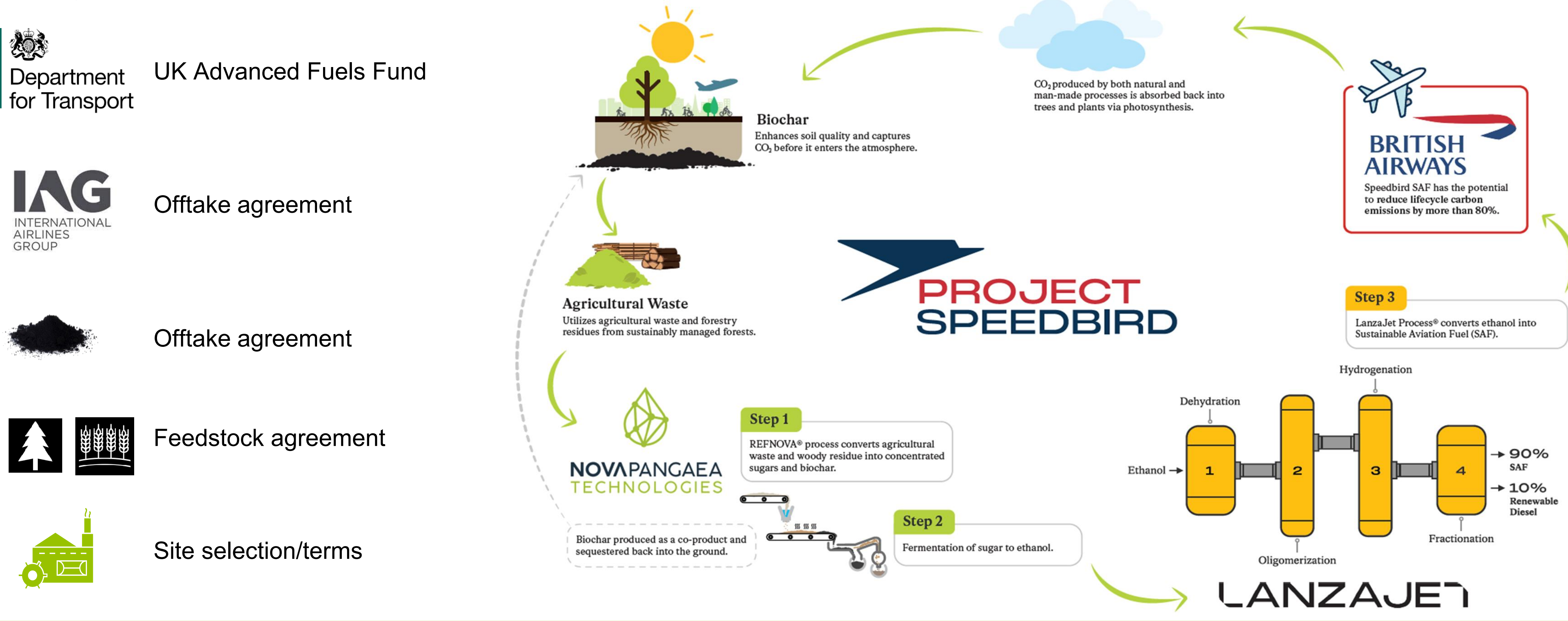
*External LCA (CO₂eq) to Puroearth methodology adapted to UK DfT requirements
Emissions for conversion Ethanol to SPK taken from LanzaJet AFF grant submission



UK PROJECT SPEEDBIRD IS A SHOWCASE FOR DEPLOYMENT

IAG flagship commercial project, delivering over 100 ml pa of fuel into the UK market by 2030

Project Speedbird Overview



190 ML PA
2G ethanol produced

4
REFNOVA Facilities

Ca 500,000
tonnes CO₂ net
emissions reductions p/a

over 50,000
BA domestic flights p/a
equivalent



**WE
PRODUCE
BIOFUEL**



**WE
LOWER
CARBON
INTENSITY**

SUMMARY

- **Negative carbon intensity products**
- **Material non crop based feedstock availability across all regions**
- **UK project Speedbird showcase underway**
- **Ready to scale – Partner model & ecosystem**

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