



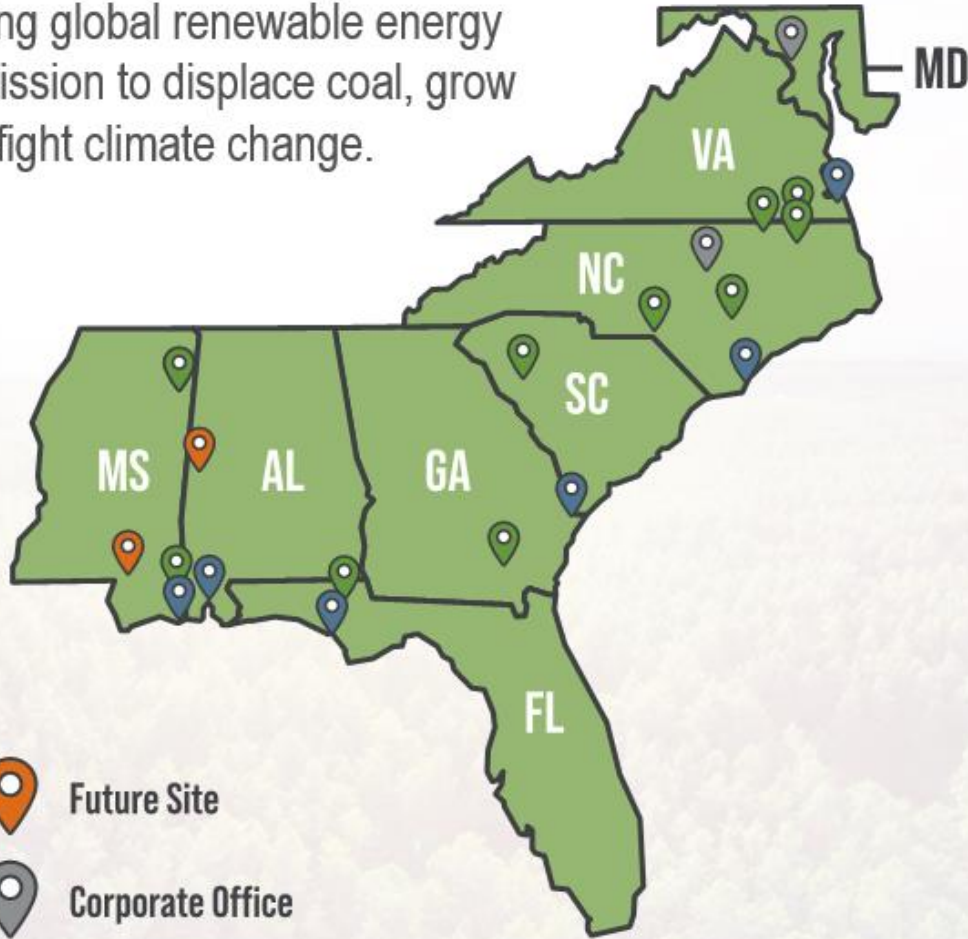
Modern Renewable Heat using Biomass for Industries

Justin Tait, Director Responsible Sourcing, Enviva

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ENVIVA AT A GLANCE

Enviva is a leading global renewable energy company on a mission to displace coal, grow more trees, and fight climate change.



- Plant
- Future Site
- Port
- Corporate Office



≈1300 people employed
Enviva



10

sustainable wood pellet
processing plants spread
across the U.S. Southeast



6

terminals leased or owned
at strategic ports across
the U.S. Southeast



5

corporate offices
located in key markets
around the world

RECOGNIZED TOOL TO FIGHT CLIMATE CHANGE



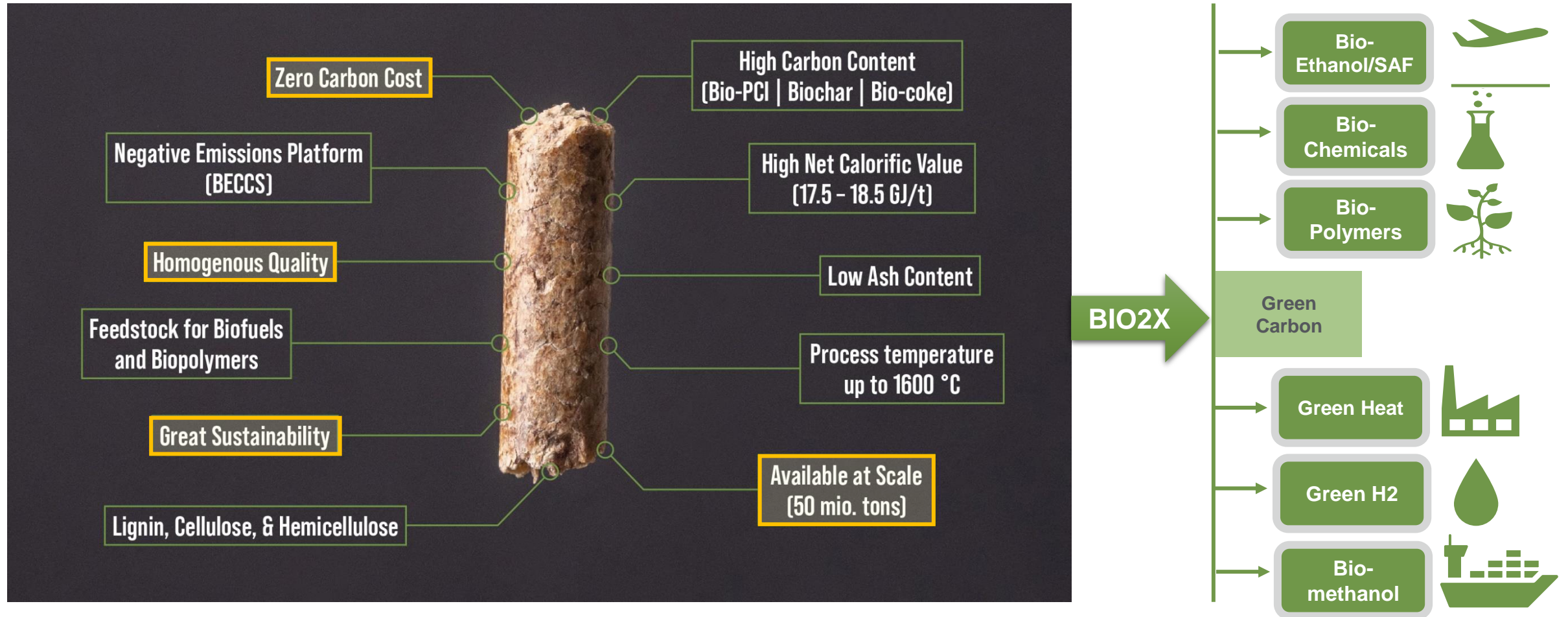
“Increased materials efficiency and new energy efficient processes making use of biomass-based fuels and CCUS are key to cutting emissions to 2030 and beyond.”



“In the long term, a sustainable forest management strategy aimed at maintaining or increasing forest carbon stocks, while producing an annual sustained yield of timber, fiber or energy from the forest, will generate the largest sustained mitigation benefit.”

“Bioenergy use is substantial in 1.5°C pathways with or without BECCS due to its multiple roles in decarbonizing energy use.”

BIO2X – EXTRACTING VERSATILE BENEFITS FROM BIOMASS



BIOMASS: UNLOCKING A FUTURE BEYOND FOSSIL FUEL



**Baseload,
dispatchable**



**Security of supply,
fixed prices**



**85% less
GHG emissions**



**70% less
GHG emissions**



**Cost-efficient,
simple conversion**



**New value chains
for hard-to-abate
industries**



**Enabler of the
bio-economy**



Sustainably sourced biomass produces and provides baseload, dispatchable, renewable fuel for generating power and heat

Biomass is a complementary solution to renewable fuels such as wind and solar, offers security of supply at fixed prices

When used to displace coal, sustainably sourced biomass can reduce lifecycle GHG emissions by **more than 85%**

When used to displace natural gas, sustainably sourced biomass can reduce lifecycle GHG emissions by **more than 70%**

Converting power plants from coal to biomass is both cost-efficient and technically simple

The woody biomass industry is poised to play a significant role in carbon removal for the future, while also unlocking **new value chains for hard-to-abate industries**

Sustainably sourced biomass is an **enabler of the bioeconomy** and helps growing more trees while replacing fossil fuels

CONTRIBUTION OF BIOMASS IN INDUSTRIAL DEFOSSILISATION



Mobility – container ships, aircraft, passenger cars, long-haul transport, etc.



Fertilizer - Support of the production process of fertilizers: ammonia and biochar



Industrial Chemistry – From the production of green naphtha to the production of phenols, lactic acid, polymers or plastics.



Health – Biopolymers as raw materials for pharmaceutical production



Biorefineries – replacement of the refining of all existing gas & petroleum-based fuels (petrol, diesel, jet, heavy fuel oil, renewable diesel, sustainable aviation fuel)



Green steel & aggregates - Biogenic substitutes in bio-PCI, recarbonization, bio-coke, sintered fuel, etc., but also in the field of lignin-based textiles, carbon fibers, cement and lime.



Green process heat - for the defossilization of energy-intensive processes in the cement-, lime-, glass-, ceramics-, pulp-, tile-, sugar- and asphalt industry.

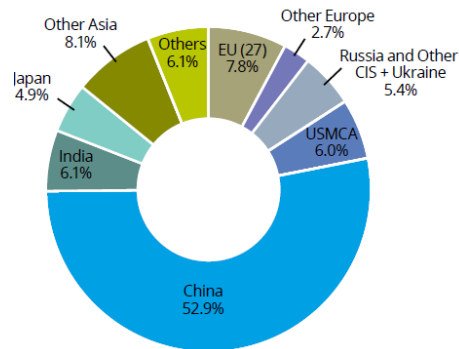


Bio- /Synthetic Fuels – Biomass-based green hydrogen, biomethanol, bioethanol, etc.

INDUSTRIAL OPPORTUNITIES: GREEN STEEL & LIME



Crude steel production
World total: 1 951 million tonnes



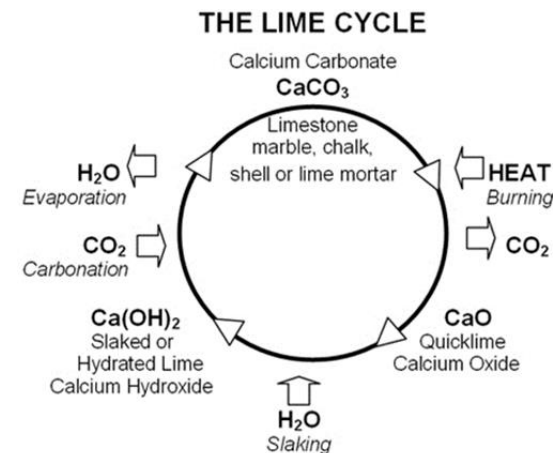
STEEL

- **EU /World demand: potential for 5 MT – 50 MT of wood pellets depending on the degree of torrefaction**
- **Requires treatment to increase fixed C content to replace coal in process**
- **Main issue is transportation of torrefied material and industrial scale of production for torrefied material**



LIME

- **EU demand >30 MT – ca. 5MTPY pellet equivalents**
- **Temp of >1500C for 15min required**
- **Already done (Italy, Germany) with waste wood**
- **Main issue is establishing local logistics and minor conversion**



INDUSTRIAL OPPORTUNITIES: SAF & METHANOL (MeOH)



SAFs can reduce carbon emissions by **80%** in comparison to using fossil-based fuels.

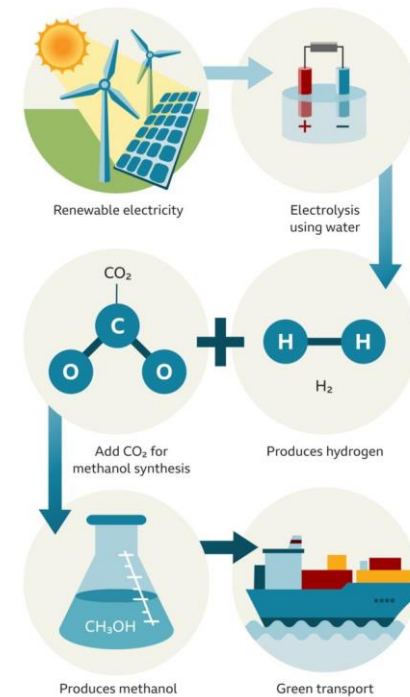
SAF

- Market size: ~ 360 Bn liters/ year
- Many technology routes to SAF
 - Pyrolysis oil and FCC
 - Flash Pyrolysis & Hydrogenation
 - Gasification and Fisher-Tropsch
- Main issue is to scale up technology and get accreditations

METHANOL (MeOH)

- Global production: ~100 million MT/year
- Ideal for **shipping** and other **heavy goods transport**
- Can be done either **with H₂+CO₂ or gasification** – and best if combined
- **Main issue:** it requires large scale MeOH synthesis plants and upscaling of gasification technology

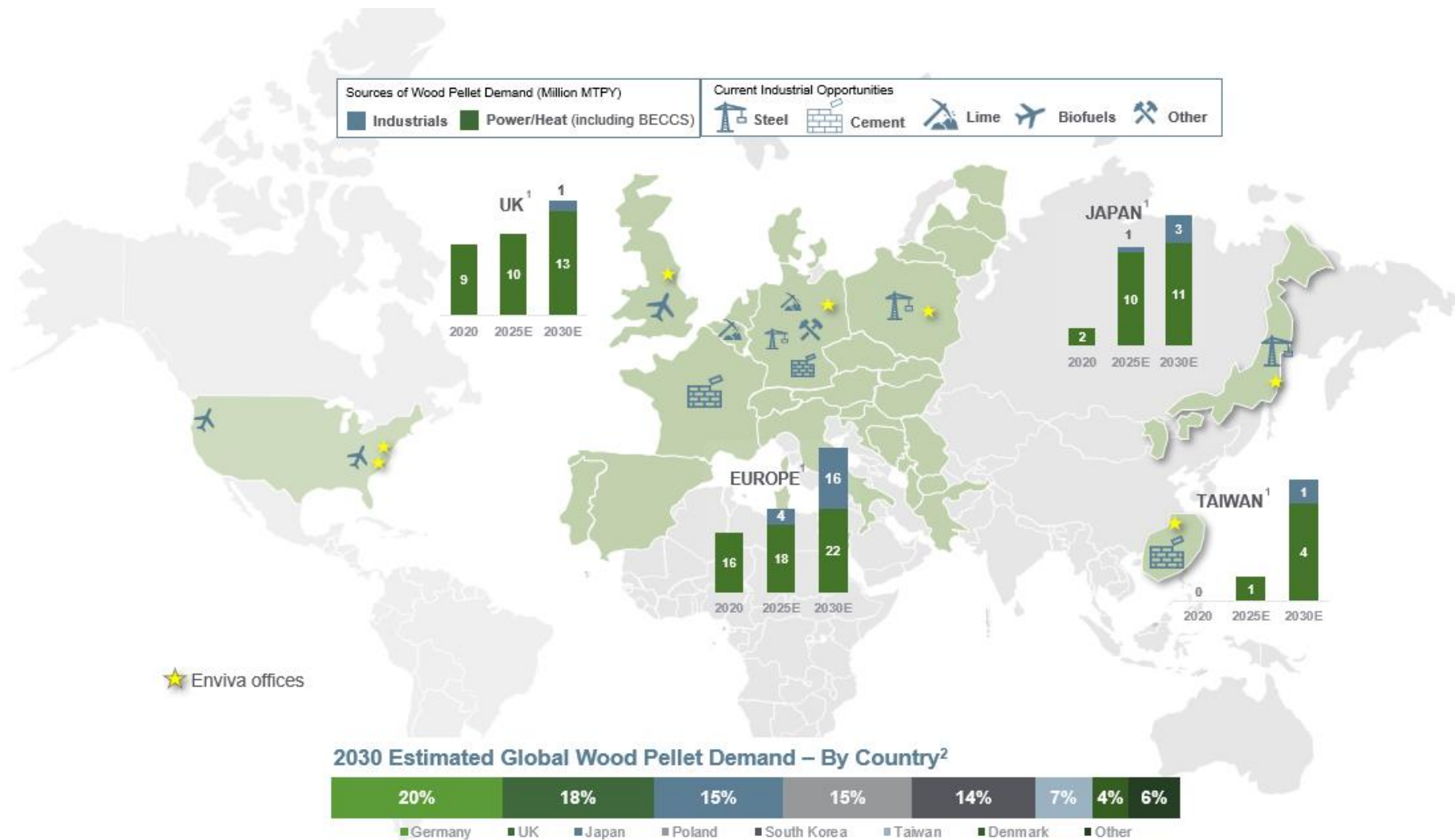
How green methanol is produced



Source: Maersk



GROWING INTERNATIONAL DEMAND





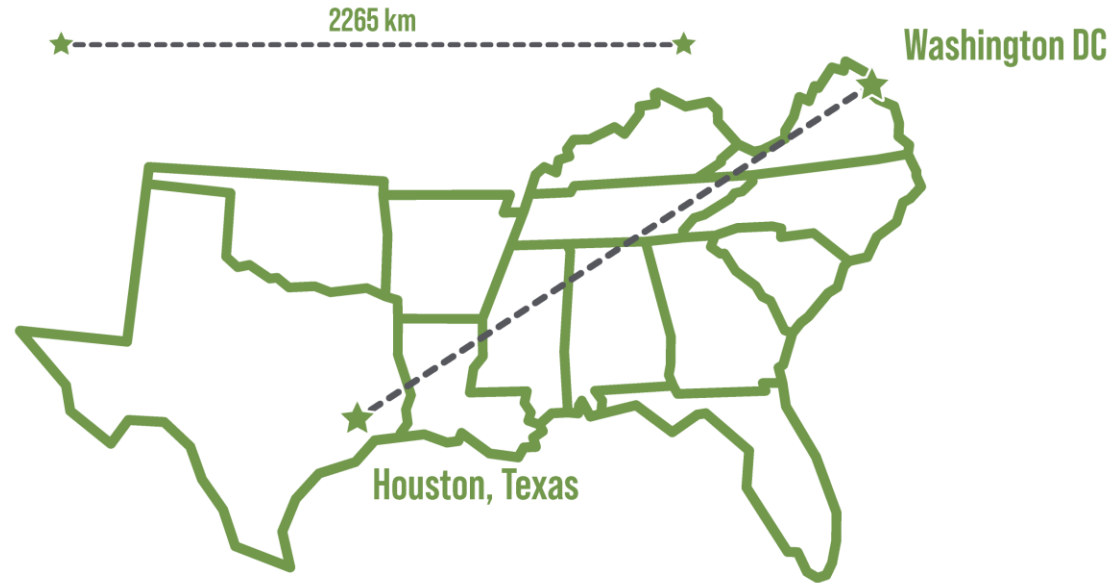
Biomass Scales

Options for large-scale biomass supply

THE US SOUTHEAST IS ONE OF THE WORLD'S LARGEST FOREST REGIONS...

**U.S. SOUTH
U.S. SOUTH
U.S. SOUTH**

1.1 million KM² of forested land which is **300x** the forested land of the Netherlands.



Forested land area in the Southeast U.S.



Total land size of Germany, Spain and Italy **COMBINED.**

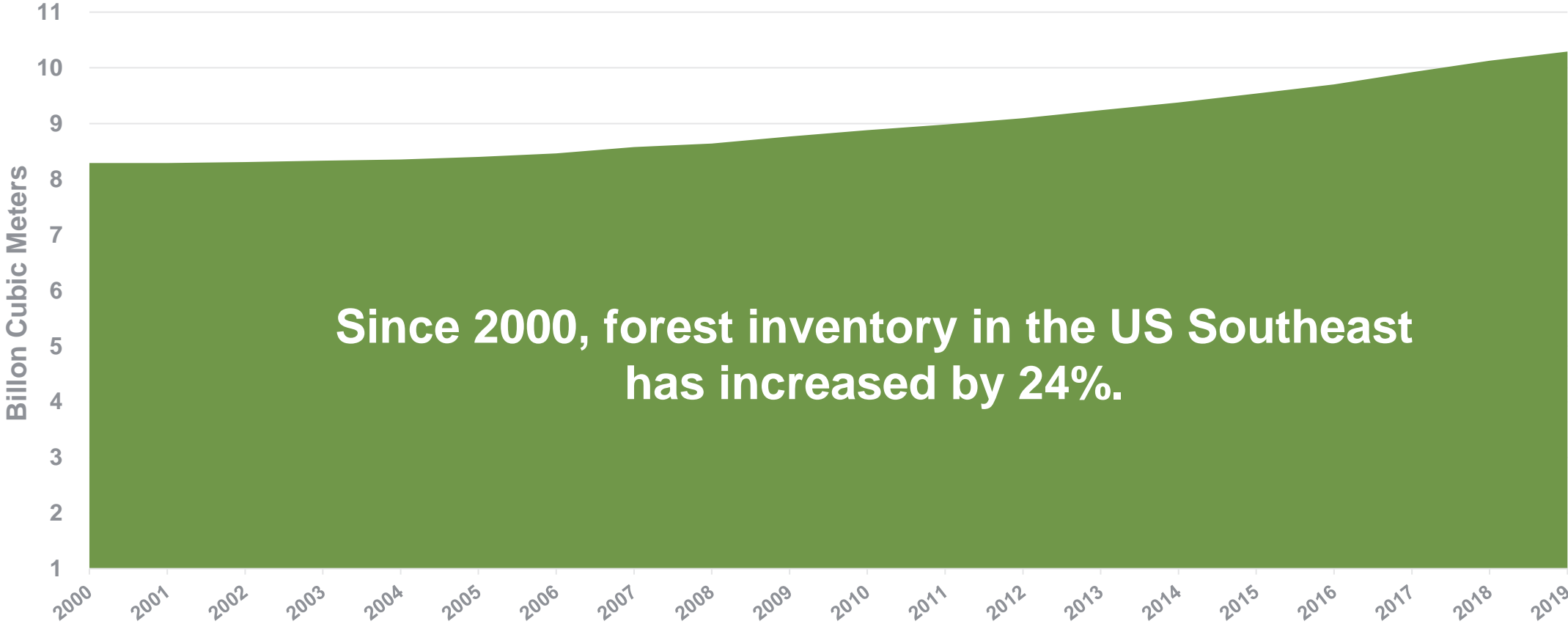
Southeast U.S. forested land



Forested land in Sweden, France, Finland, Spain, Norway and Germany **COMBINED.**

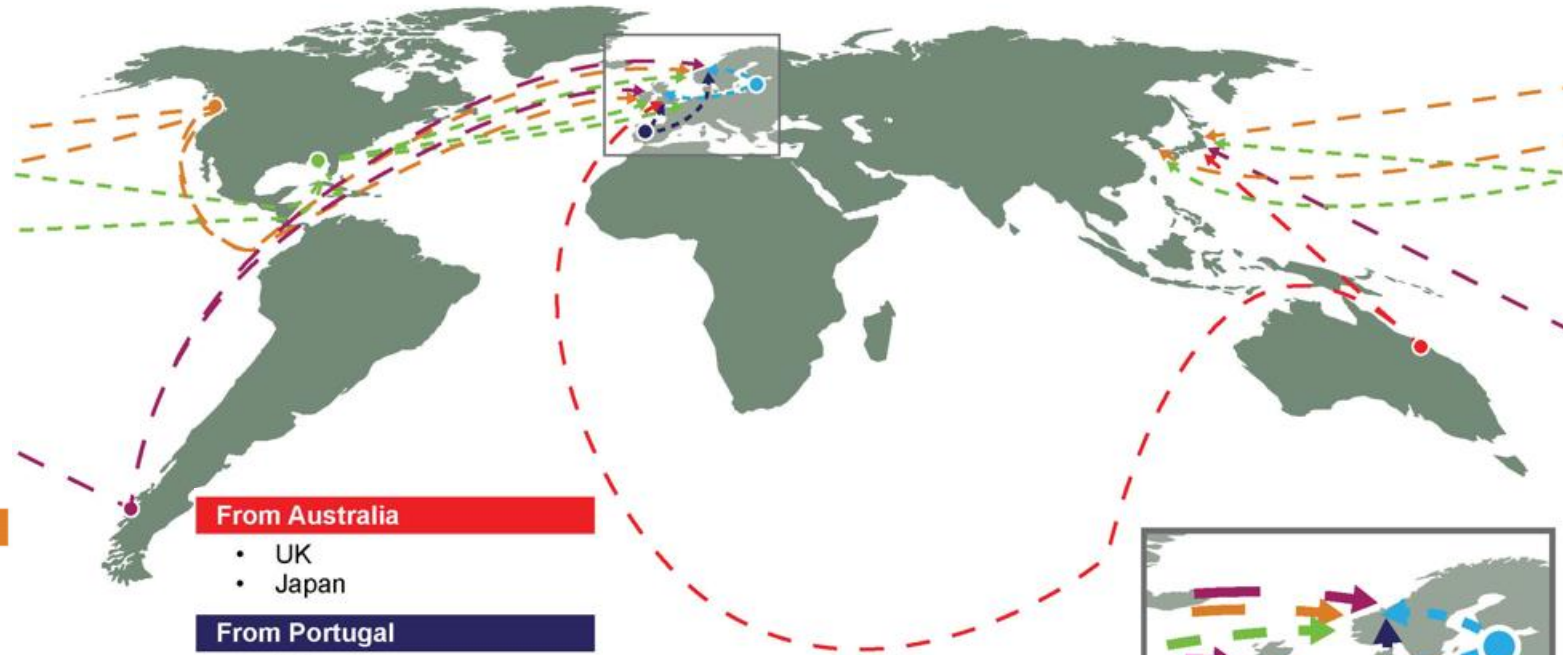
...AND THE FOREST CONTINUES TO GROW EVEN AS WE TAKE MORE WOOD PRODUCTS FROM IT...

Total Forest Inventory of the US Southeast



GLOBAL COMMODITY, ESTABLISHED SUPPLY CHAINS

Wood Pellet Shipments 2020 – 2024



From Canada

- UK
- Netherlands
- South Korea
- Japan

From Chile

- UK
- Denmark
- Japan

From Baltics

- Denmark
- UK

From Australia

- UK
- Japan

From Portugal

- UK
- Denmark

From Southeastern US

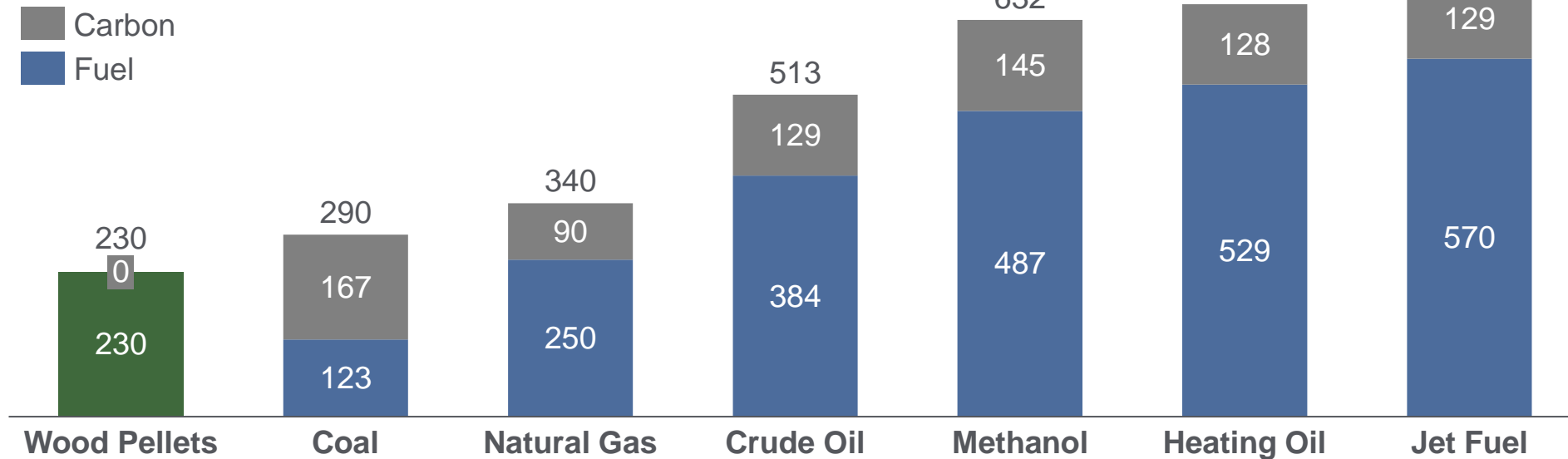
- Japan
- UK
- Denmark
- Belgium
- South Korea
- Caribbean



Source: Enviva

BIOMASS PRICE ADVANTAGES OVER FOSSIL FUELS

Fuel and Carbon Cost in Europe 2025*
USD/17GJ



- Biomass continues to be price competitive and has kept its relative position for more than 6 months
- Wood pellets are competitive with gas without carbon in Europe on forward-looking basis

**Forwards 9 June 2022 (Oil, Jet Fuel and Methanol 2022 prices assuming forward curve is flat)*



Questions?

www.envivabiomass.com