Forest Energy

CO_2 Neutral Energy + Carbon Sink using Local Biomass

Forest Energy
Founder and CEO, Shingo Numa

Forest Energy's Local Biomass Energy Model

- We operate SMALL biomass power plants (40kw – 2,000kW, CHP), using LOCAL BIOMASS to produce LOCAL ENERGY
- We use PYROLYSIS / GASIFICATION technology for high energy efficiency and CARBON NEGATIVE process

LOCAL BIOMASS

Use of THINNED WOOD

- Promote proper forest maintenance
- Increase employment in forestry

SHORT distance transportation

- Low emission
- Increase local employment

LOCAL ENERGY

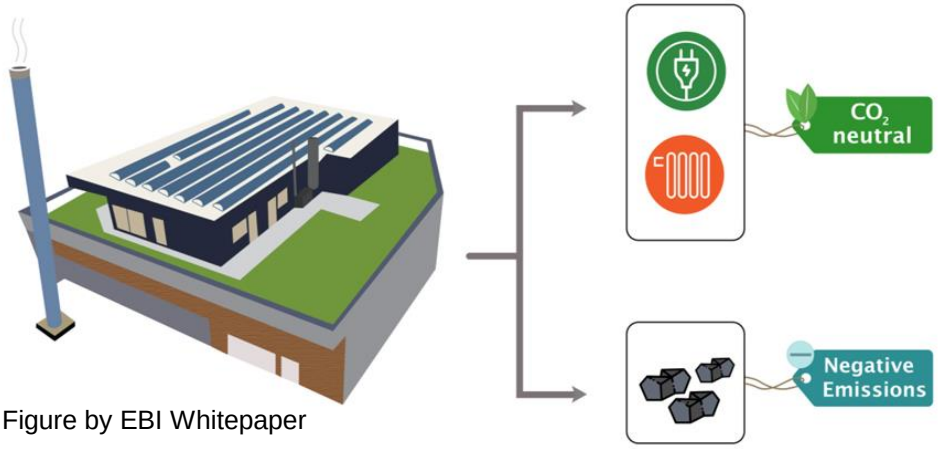


Figure by EBI Whitepaper

Thermo-chemical transformation

- Compact in size
- High energy efficiency

1. CO_2 neutral electricity
2. CO_2 neutral heat
3. Biochar
4. Negative emissions

- Baseload electricity source

Example: Shingu Forest Energy

- CHP is small and efficient, thus is perfect for decentralized energy source

- Power generation: 1,764kW
- Shingu City, Wakayama prefecture, Japan
  - Population: 26,841
  - Land: 25,523 ha
  - Forest rate: 91%
- In operation since 2021
- Biomass: Thinned wood from local forest. 20,000 t/y
- Electricity off-take: Feed-in-tariff
- Heat off-take: used for drying biomass

SYNCRAFT® Climate Positive Solutions.

Example: Tsuwano Forest Energy

- CHP is small and efficient, thus is perfect for decentralized energy source

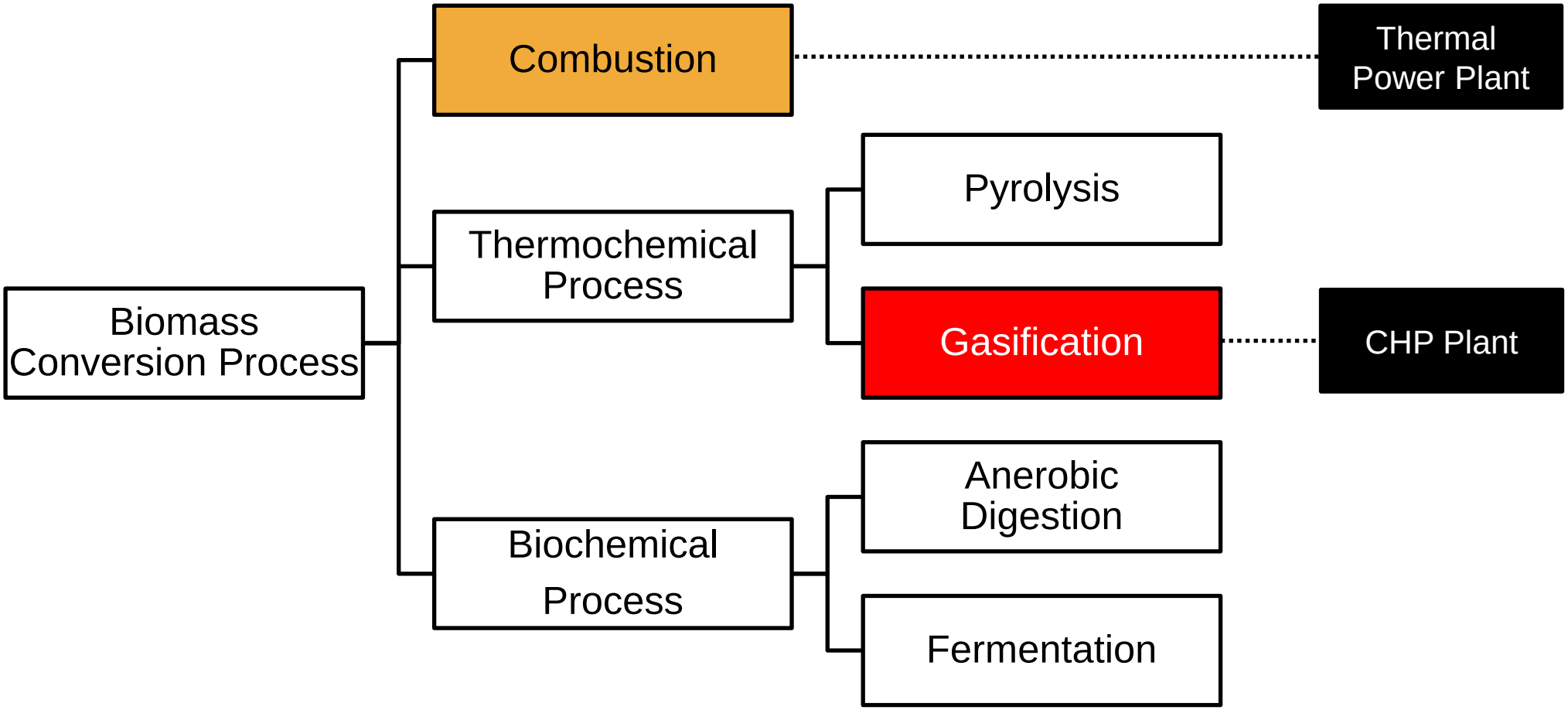
- Power generation: 480kW
- Tsuwano town, Shimane prefecture, Japan
  - Population: 6,875
  - Land: 30,704ha
  - Forest rate: 90%
- In operation since 2022
- Biomass: Thinned wood from local forest. 6,000 t/y
- Electricity off-take: Feed-in-tariff
- Heat off-take: used for drying biomass

Example: Biomass CHP and ZEB (net-zero energy building)

- Takasago Research Center is powered by solar and biomass CHP
- Heat from CHP is used for both COOLING and HEATING
  = Desiccant air conditioning
- Surplus electricity is stored in 3MW battery

Converting Biomass into Energy

- When combusted (burned), biomass is converted to HEAT + CO_2
- However, by thermochemical process such as pyrolysis and gasification, biomass is converted to ENERGY GAS (SYNGAS) and CARBON (BIOCHAR)

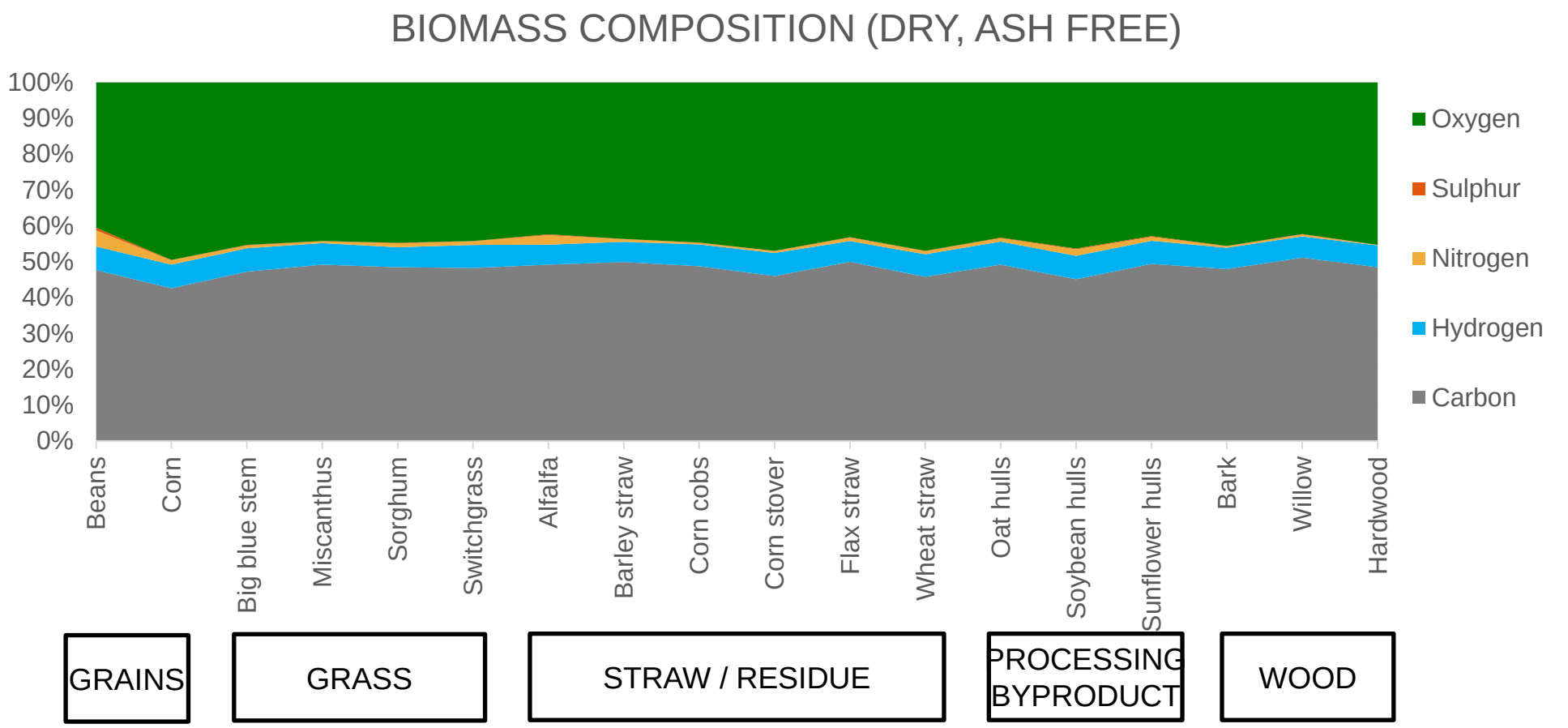


Biomass contains Carbon, Hydrogen and Oxygen

- Physical character of biomass is different
- However, element is nearly the same = $C + H_2 + O$

GASIFICATION

Energy Gas
H_2 & CO

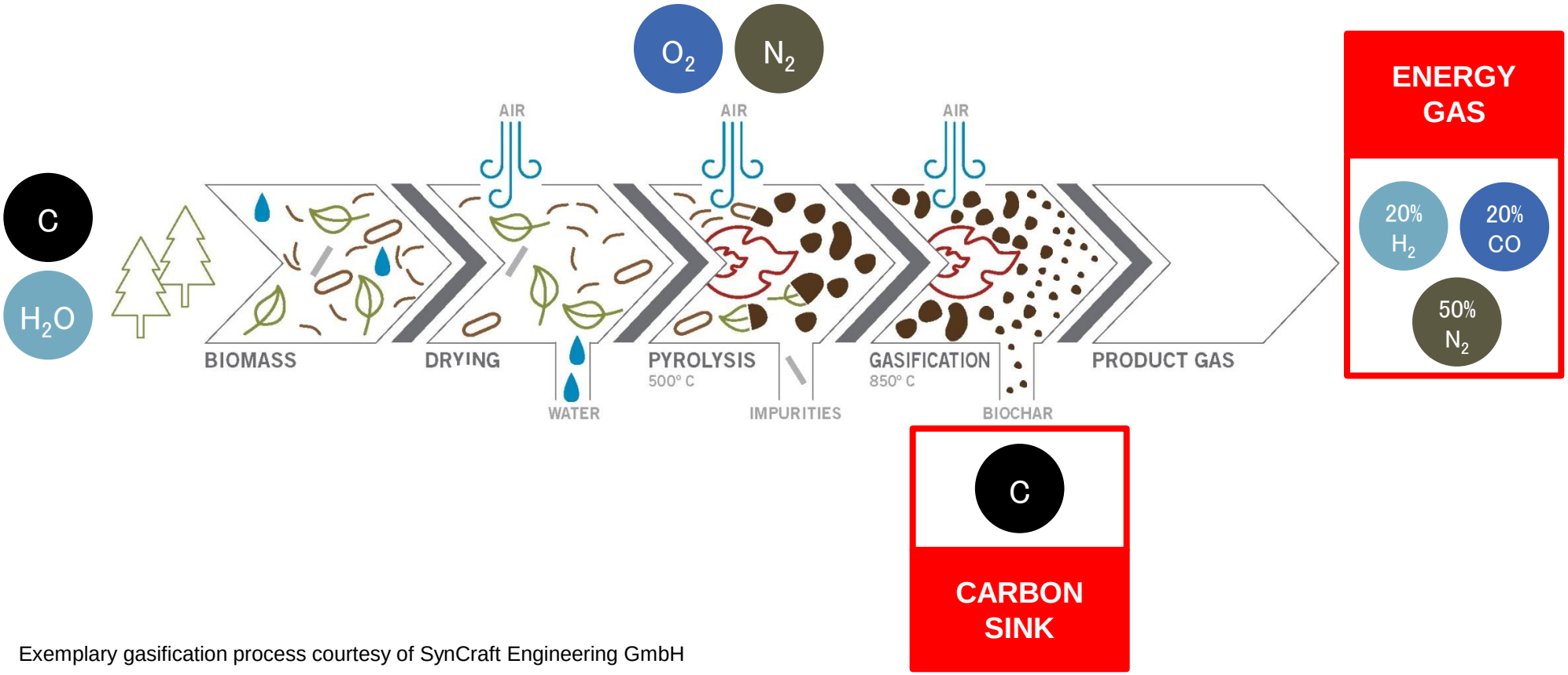


Data compiled from AURI, 2005; Preto, 2010; and graph made by Forest Energy

Biomass Gasification Technology

- Through PYROLYSIS and GASIFICATION, biomass is converted into ENERGY GAS (Syngas)
- Residue of energy is BIOCHAR (Carbon)

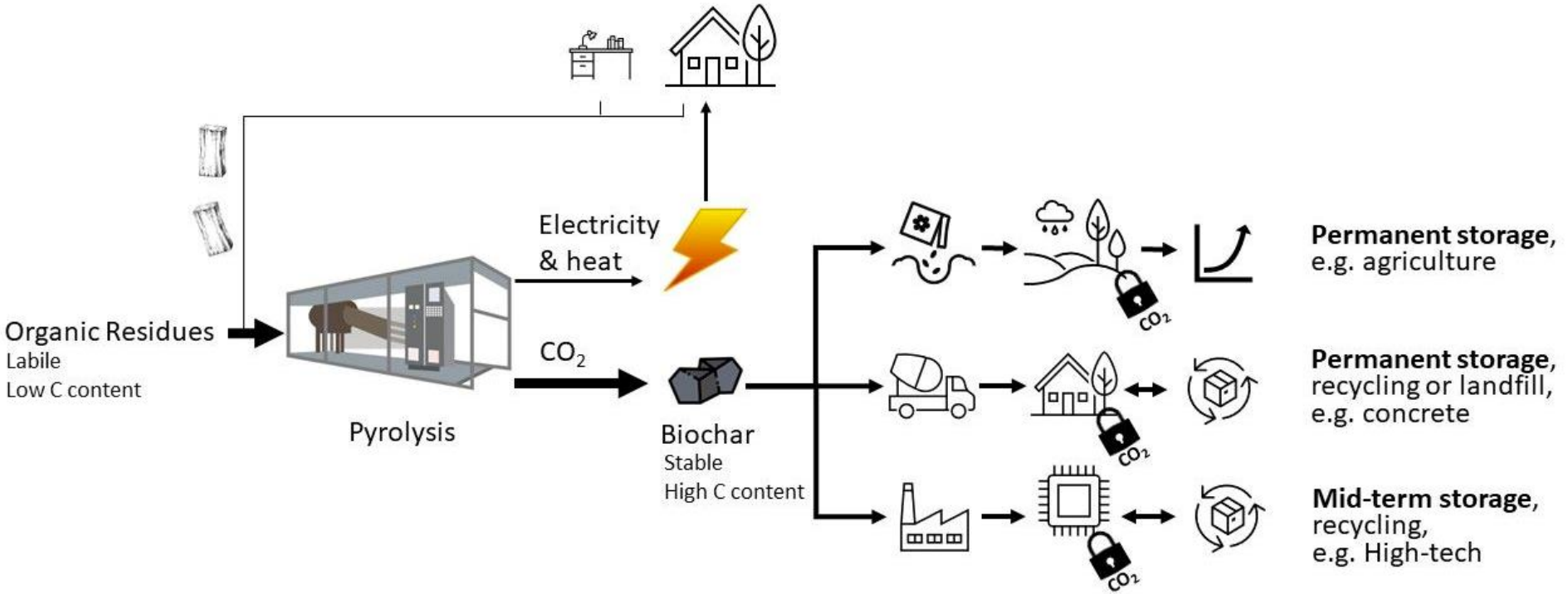
PROCESS FLOW OF GASIFICATION



Exemplary gasification process courtesy of SynCraft Engineering GmbH

Carbon Sink using Biochar

- BIOCHAR can be produced as BYPRODUCT of energy production
- Today, there are three categories for carbon removals.
  Biochar fits into ALL categories of carbon sequestration
  1. Permanent storage
  2. Carbon farming
  3. Product storage



Thermo-chemical transformation

Functional storage

Figure by EBI Whitepaper

Carbon Sink and Carbon Credit

- CARBON CREDIT can be issued for the carbon sink by biochar
- There are public markets and number of voluntary market to issue and trade carbon credits; J-Credit (Japan), Verra, Carbonfuture, Puro.earth …
- Quality criteria, strict MRV (Measurement, Reporting and Verification) and third party accreditation is critical to development of the market

CARBON FARMING

SOIL IMPROVEMENT

ORGANIC FARMING

- Biochar can increase soil fertility, water holding capacity and crop productivity
- Biochar increases soil carbon content and provides longer-term carbon sequestration than soil organic carbon

PRODUCT STORAGE

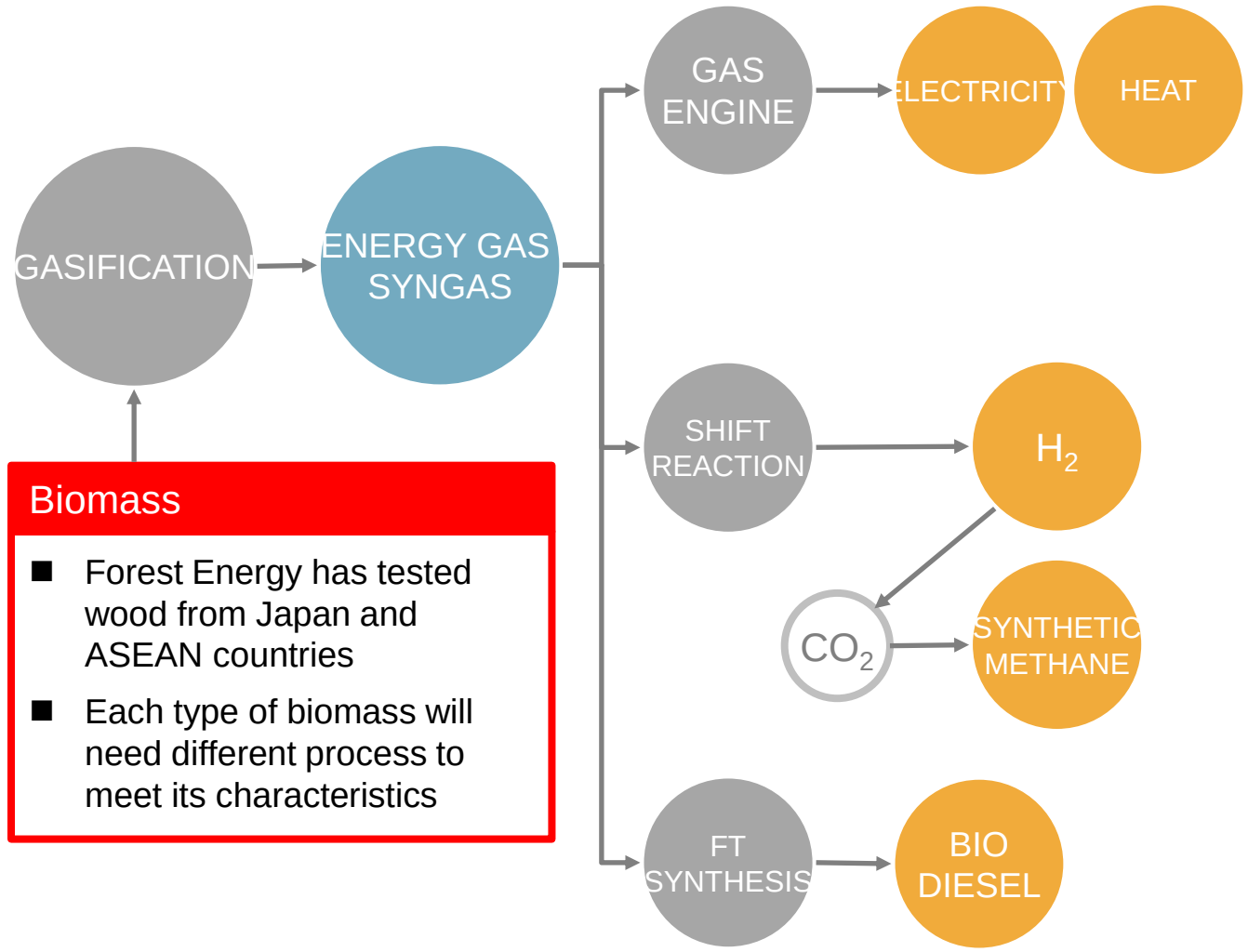
ASPHALT

CONCRETE

Picture courtesy of Syncraft and partners of Forest Energy

Various Energy Output using ENERGY GAS

- ENERGY GAS is converted to ELECTRICITY and HEAT by using gas engine
- By using petrochemical technology, ENERGY GAS can be converted to GREEN HYDROGEN, GREEN LPG or BIO-DIESEL



Biomass

- Forest Energy has tested wood from Japan and ASEAN countries
- Each type of biomass will need different process to meet its characteristics

Commercialized

- CHP, Combined Heat & Power
- Baseload electricity source
- Distributed power supply, used in many EU countries. Japan underway
- Power generation efficiency 20-30%
  Total energy efficiency 80-90%

Demonstration in progress

- Gas to Gas
- Onsite H2 production
- Green LNG
- Green LPG

Laboratory test

- Biomass to Liquid (BTL)
- Bio jet fuel

Example: Japanese Company planning to use H_2 from Biomass

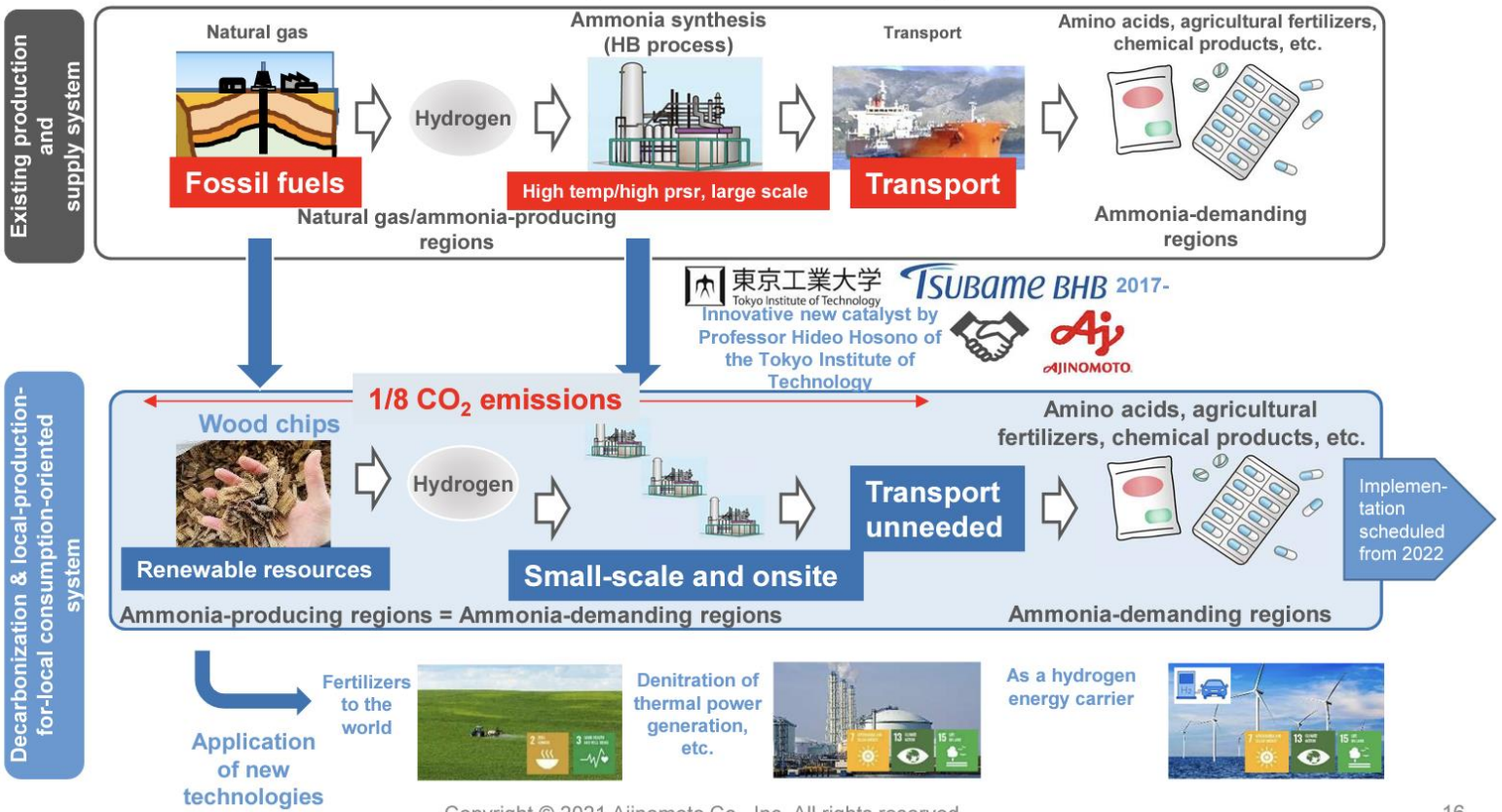
- Small-scale and On-site production of H_2 using Local Biomass / Gasification

Eat Well, Live Well.

AJINOMOTO

Green Innovation in Ammonia Production and Supply

We will contribute to the environment through the realization of "green ammonia," through the use of renewable resources and the construction of a local-production-for-local-consumption system for ammonia production and supply using innovative new catalysts



Ajinomoto, IR Day 2021, Sustainability Initiatives