# Yosemite Clean Energy – Providing Los Angeles Waste to Renewable Fuels Solutions

YOSEMITE
CLEAN ENERGY

# CA's Waste Biomass Liability

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## CA forests destroyed by wildfires 2016-2022[1]

- 11.2+ MM acres burned
- 195+ lives lost
- 51,664+ structures destroyed
- 2MM structures at high or extreme risk[2]

## At the end of orchards' lifecycles, they are either burnt or chipped

- Particulate matter and pollutants saturate the air we share
- Pushing, chipping, trucking, and added fertilizing costs become a liability for farmers

1. https://www.fire.ca.gov/incidents/
2. www.verisk.com/insurance

# Technology

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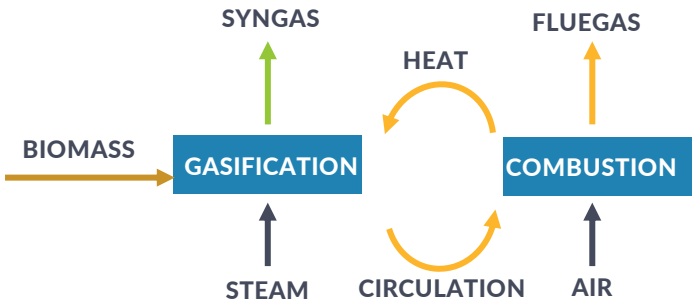
Technical University Vienna/Austria

## Repotec

### Dual-Bed Gasifier




**Successfully commercialized in Europe for over**

**20 years**

**Using proven, innovative gasification technology to make**

**Carbon Negative**

**syngas and produce:**

$H_2$ **Green Hydrogen**

# Stump-to-Pump Block Flow Diagram

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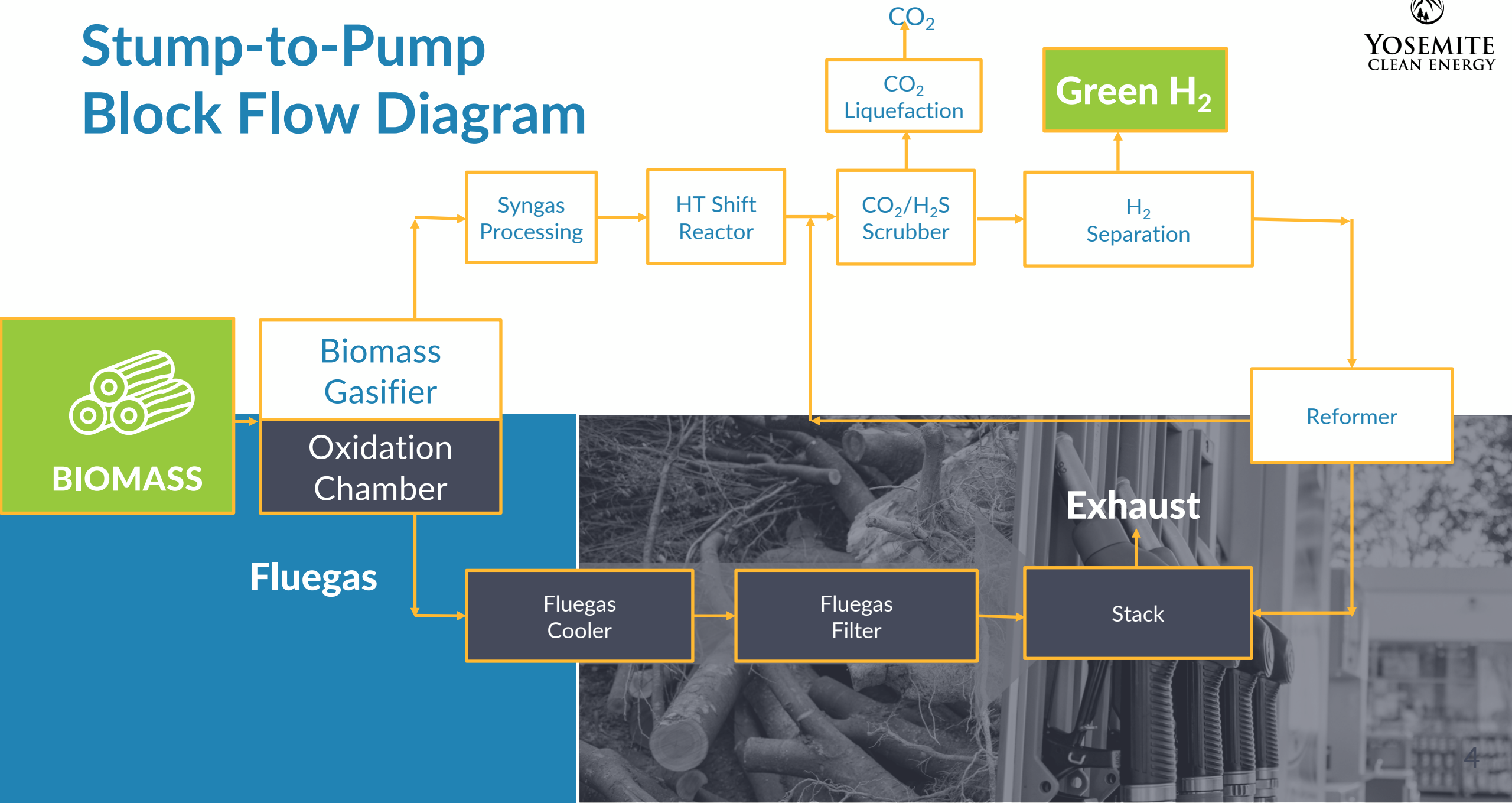
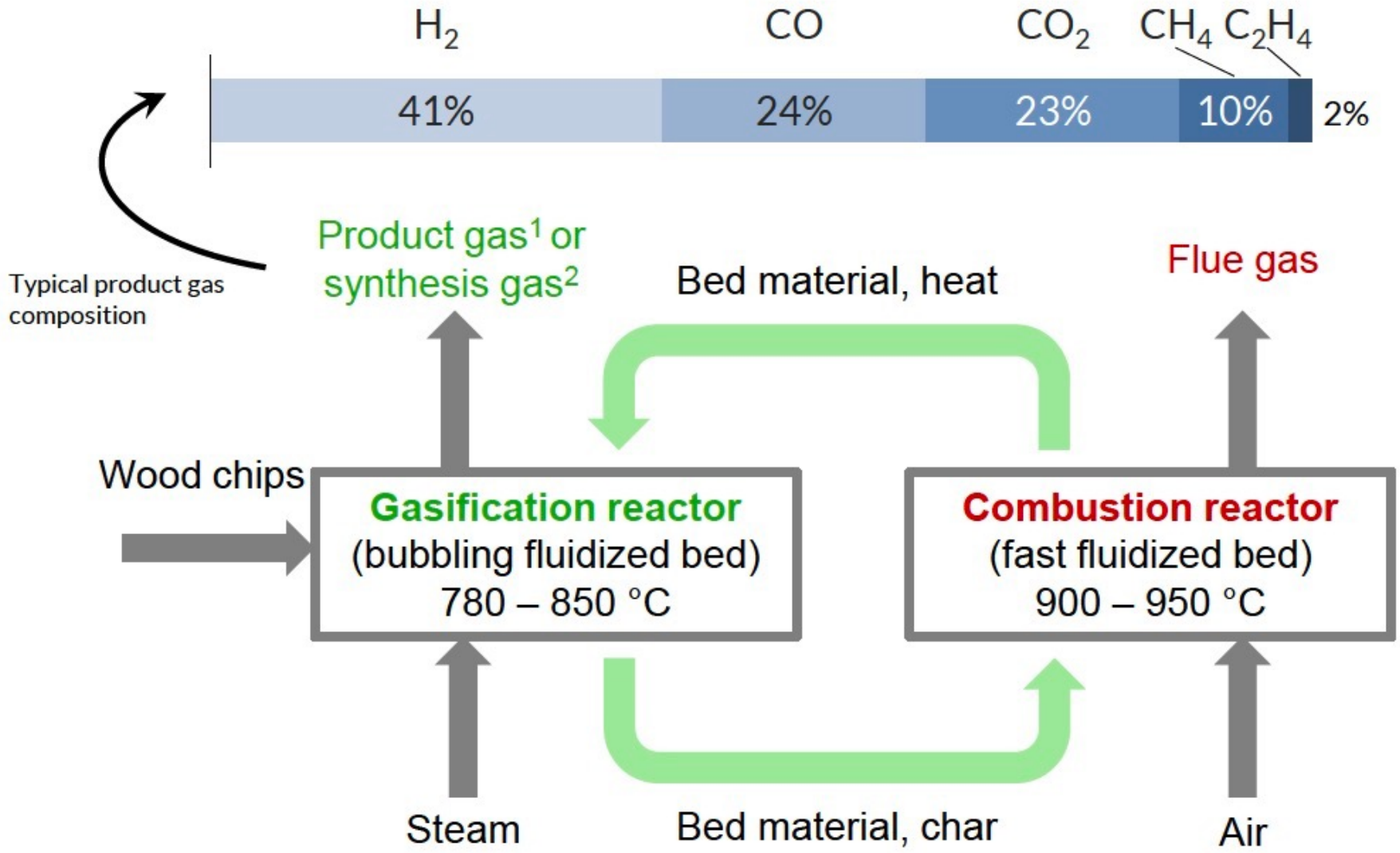


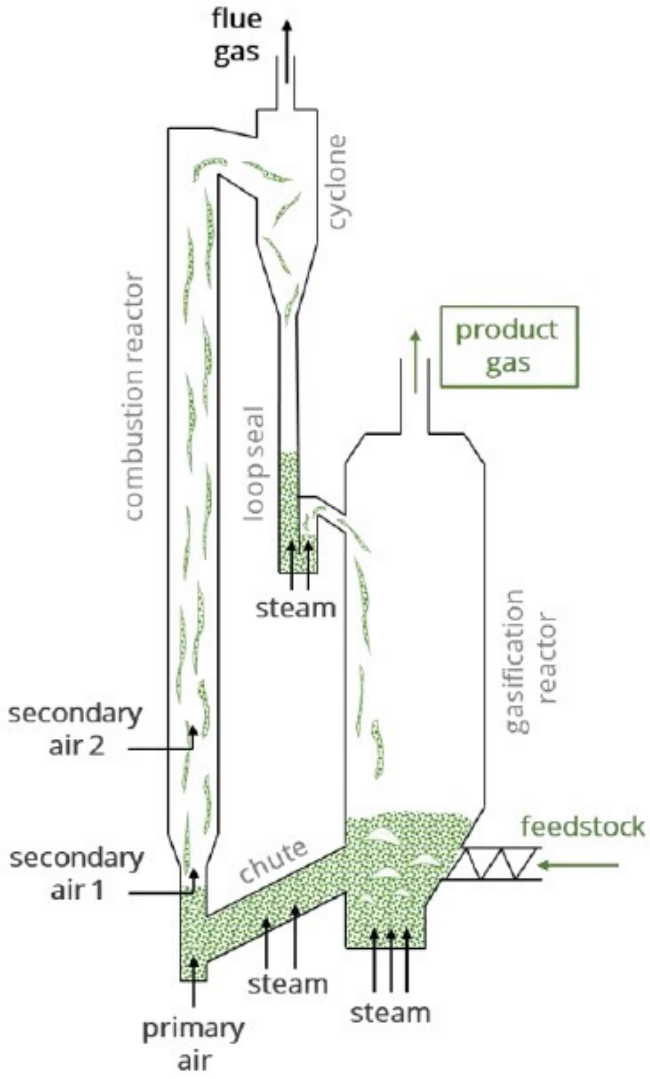
# Syngas from DFB gasification




1 e.g. tar (incl. BTEX): 20-30g/m³, $H_2S$ ~100 ppm for biomass fuel before any gas cleaning for downstream processing

2 Synthesis gas = cleaned from impurities

# DFB: Woody biomass as input
# 1st generation reactor design



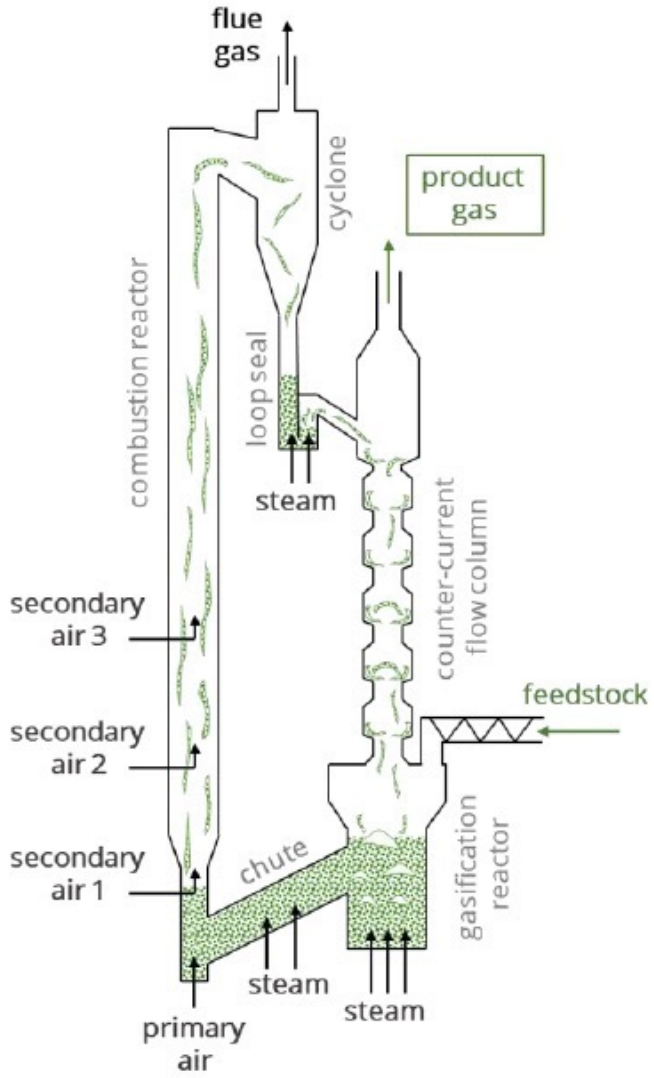

**DFB Design**
**1. Roll-out**

Gasification Reactor: bubbling fluidized bed with freeboard above.

Light material and volatiles are not in close contact with bed material and cannot be intermixed in the fluidized bed

Low conversion, high amounts of undesired tars in the product gas.

# DFB: Residues and waste as input
# 2nd generation reactor design




**DFB Improved Design**
**2. Roll-out**

Gasification Reactor: Bubbling fluidized bed with counter-current flow column above.

Light material and volatiles are now in better contact with bed material as they are forced to be in contact in the counter-current flow column.

Higher conversion, lower amounts of undesired tars in the product gas.

# Shifting research focus in 2nd generation DFB

Shifting Research Focus

**Residues and waste**
forestry, agriculture, industry and WWT


**Syngas Platform Technologies**

Optional: Peak-wind energy

**Refinery products**
- Wax
- Jet Fuel
- Alcohols
- Diesel

**Gases**
- Hydrogen
- SNG
- Syngas combustion

**CHP**
- Electrical
- Thermal

Shifting Research Focus

# Versatility of the DFB gasification technology for the production of liquid poducts

| C-Conversion | Intermediate | Conversion | Final products |
|---|---|---|---|
|  | **FT-Liquids** | Steam cracking | $C_{+4}$ Olefins |
| | | Separation | $C_2$-$C_4$ olefins |
| | **FT-Waxes** | Hydro-processing | Diesel, SAF |
| Synthesis<br>➢ Low temperature Fischer-Tropsch synthesis<br>➢ Methanol / Mixed alcohol synthesis | **Alcohols:**<br>Methanol<br>Ethanol<br>Propanol | Separation | e.g. pure alcohols |
| | | "Alcohols-to-Olefins" | $C_{+4}$ Olefins |
| | | "Alcohols-to-Fuel" | SAF |

# Demonstration and industrial reference projects based on DFB steam gasification from 2002 – 2022

1st gen CHP

8 MW
Güssing

1st gen CHP

8.5 MW
Oberwart

1st gen CHP

14 MW
Villach

1st gen CHP

15 MW
Senden/Ulm

32 MW
GoBiGas

1st gen bioSNG

3.8 MW Nong Bua
(Thailand)

1st gen CHP

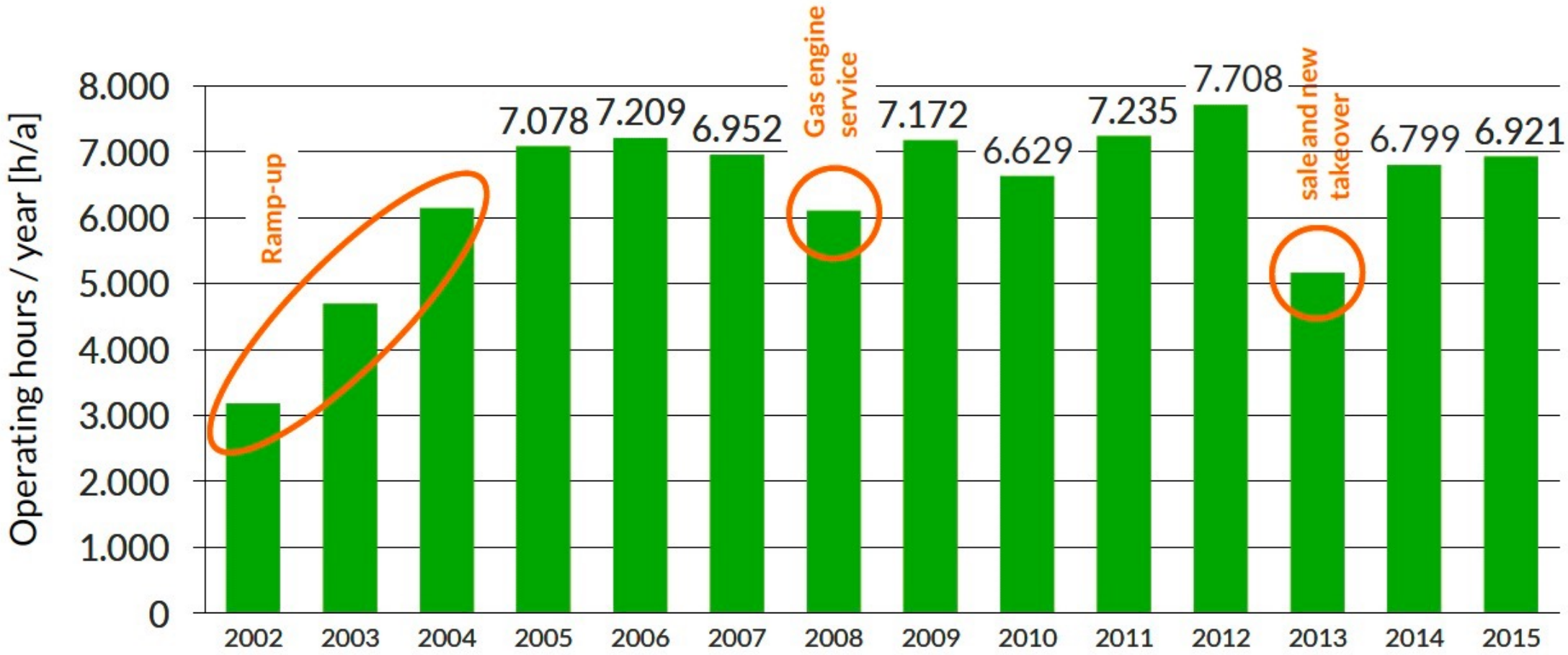
0.5 MW
GAYA / Engie

Adapted 1st gen bioSNG

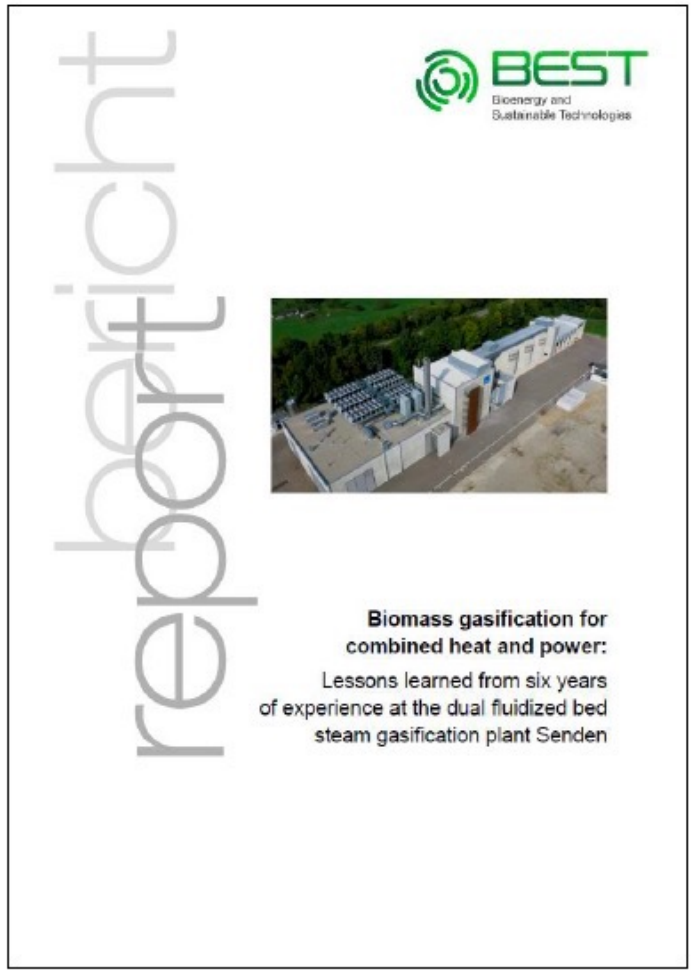
1 MW
Syngas Platform Vienna


2nd gen Fischer-Tropsch

# Yearly operating hours of Güssing DFB (1st generation DFB based on woody biomass)



# Key technical lessons learned from field experience during the first commercial roll out




The first commercial roll out of the DFB steam gasification technology was accompanied by BEST and TU Wien and is well documented in multiple scientific works, such as theses and scientific articles (more than 200 in total).

In addition, BEST has compiled a comprehensive report on the field experience at the DFB steam gasification plant Senden / Ulm, Germany.

Key technical lessons are well evaluated and documented.

# Chronology of demo and industrial projects (II): The second commercial roll out

## 32 MW GoBiGas


Comissioning: 2013/14

End of operation: 2018

## 0.5 MW GAYA / Engie


Comissioning: 2016

In operation (demo campaigns)

The goal is to operate demo cases with different biomass and waste streams for further upscaling

## 3.8 MW Nong Bua (Thailand)


Comissioning: 2017

In operation (demo campaigns)

The goal is to operate demo cases for further upscaling in the Asian market

## 1 MW Syngas Platform Vienna


Comissioning: 2022

In operation (demo campaigns)

The goal is to operate demo cases with different biomass and waste streams for further upscaling

BEST

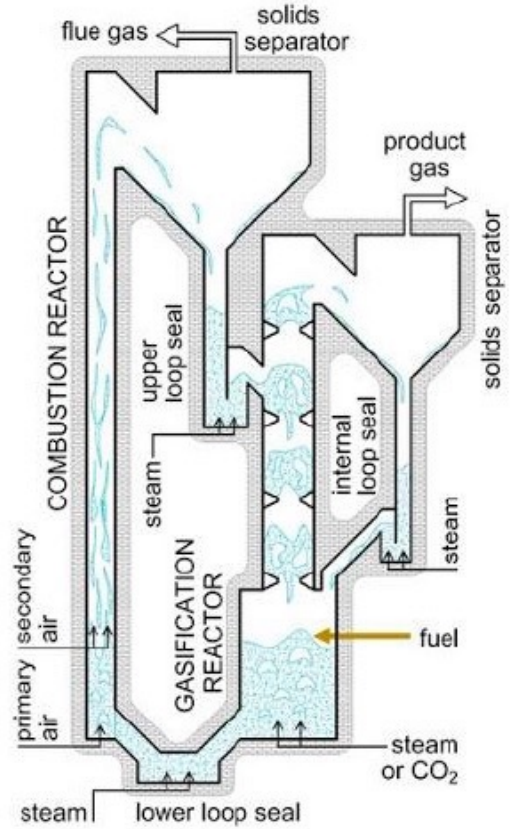
| | |
|---|---|
| **Scale** | **1 MW DFB gasification<br>250 kW FT synthesis** |
| **Operation** | Research campaigns |
| **Fuel** | Biomass, biogenic residues and waste |



TU WIEN

Based on 100 kW DFB pilot plant of TU Wien

# Fuels already tested in 100 kW DFB pilot plant at TU Wien

# “From Stump to Pump” – YCE’s Process

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1.Forest and agricultural management and operations  completed on public and private land: environmental best practices to restore forests, ecosystems, watersheds, and agricultural land

2. Wood waste transported to plant by forest management partners, usually minority owners in the projects

3. Depending on the season, wood waste is dried in an air dryer on site to reduce water content to +/-20 percent

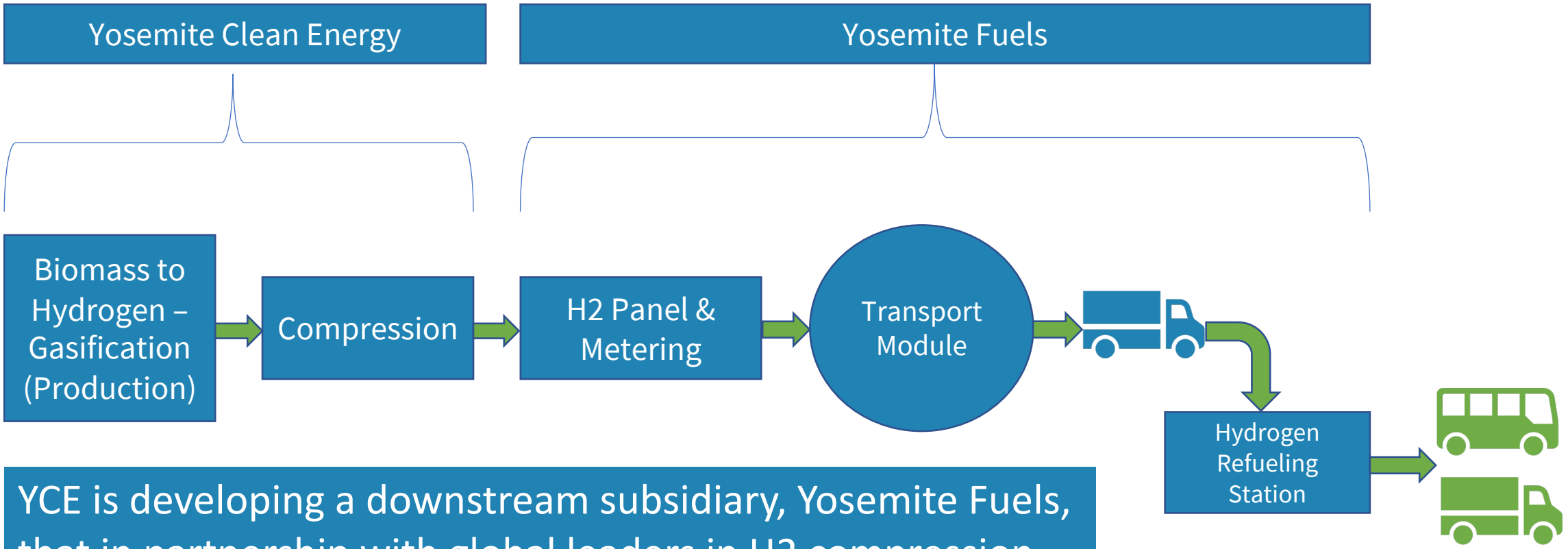
4. Wood chips are gasified in a dual bed gasifier developed by Aichernig Engineering (“Repotec”)

5. High BTU syngas is converted to hydrogen and CO2 using water gas shift, PSA, and Topsoe tail-gas reformer. CO2 amine scrubber provided by technical vendor TBD

6. Hydrogen is compressed to 350 bar, loaded on a tube trailer, and driven directly to fueling sites

7. Trailers dropped and swapped at fueling stations, so as to reduce recompression. Trailers serve as storage for fueling stations, based on best-in-class systems currently in operation

# Hydrogen Downstream Build Out – Yosemite Fuels




YCE is developing a downstream subsidiary, Yosemite Fuels, that in partnership with global leaders in H2 compression, transportation, and storage, to provide turnkey solutions to fleets and and transit authorities

# Investors and Partnerships

YCE has received almost all of its seed investment from strategic partners who own or manage biomass on a commercial scale, and has received 5 grants from state and federal agencies

Grant funding:

**June 2023:** $5M from CEC
**Jan. 2023:** $1M from DOC
**May 2022:** $500k from Cal Fire
**May 2022:** $250k from USFS

## Policy & Advocacy

Sustainable Markets Initiative
Bioenergy Association of California
Low Carbon Fuels Coalition
Kilpatrick Townsend
Alternative Fuels & Chemicals Coalition

## Funding Partners

Leslie Heavy Haul
HilltopSecurities Investment Banking Solutions
Forest Service U.S. Department of Agriculture
Old Durham Wood, Inc. Wood Grinding Orchard Removal Excavating Land Clearing
Bamford
CAL FIRE Since 1885
State of California Energy Commission — California Energy Commission
California Department of Conservation

## Engineering & Technology

BEST Bioenergy and Sustainable Technologies
PSC Primoris
repotec renewable power technologies
MMR Power Solutions
TOPSOE

## Forestry Experts

BioStewards Creating Value. Innovating Stewardship.
DRS
Butte County FireSafe Council
Sierra Resource Management, Inc.

## Local Support

Butte County California
B-Line Butte Regional Transit
Tuolumne County Transit
City of Oroville, California
BCAG
California Cattlemen's Association CCA
County of Tuolumne California
Chicken Ranch Economic Development Corporation
Tuolumne County Resource Conservation District

## Downstream Partners

GUNVOR
California Resources Corporation

# The Leadership Team:

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**Thomas Hobby, MSc., MA, MBA, P. Ag, CEO & Managing Member**
-Prior CEO, Highbury Energy
-35 years of forestry, R&D, start ups & Non-profits
-Founded NGO that led to $25mm R&D
-Analyzed 2.5mm forest acres

**Robert Jackson, VP Bus. Dev. & Managing Member**

-35 years enterprise development, finance, & startup management
- Numerous successful property development transactions

**Loren Dubberke, VP Social Impact & Managing Member**

-35 years in community development and social enterprise management
-Recognized leader in under-resourced community restoration

**Zakiul Kabir, CTO**
-25 years in clean tech, including fuel cells, distributed power generation and large-scale solar thermal
-18 years of technical management experience (SVP/CTO/COO)

**Bill Kehoe, CFO**
-20 years building businesses and working with executive leadership teams, BOD, and outside partners
-Proven track record in entrepreneurial environments

**Austin Terry, Director Downstream Dev.**
-20 years executive and project management experience in energy infrastructure development, EPCM, and pipeline construction

**Michael Zahradnik, Director International Bus.**
-led commercial planning and development of gasification plants since 2008
-Senior Project Manager for both Repotec and Gussing GmbH

Sustainable Markets Initiative

YCE is a key participant within the Sustainable Markets Initiative founded by King Charles III (www.sustainable-markets.org). YCE chairs the Hydrogen Transport and Storage workstream in support of lowering hydrogen supply chain costs. Through SMI, YCE led a global report that was published in Q1 2023 on the current state and future developments of hydrogen storage and transport.