

Small Scale Gasification and Pyrolysis: State of Technology and Near Term Opportunities



Biofuels and Beyond: Innovative
Technologies and Coproducts
Harvesting Clean Energy
Kennewick, WA
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T R Miles Technical Consultants



Opportunities in the PNW

- Solve a disposal cost or environmental problem
 - Forest restoration (mobile pyrolysis)
 - Refuse reduction
 - Field crop residue use
- Increased value of co-products
 - Biochar, oil, power
- Co-fire renewable fuels
- High value low production products
 - Flavoring, fuels
- Prepare intermediate products for fuel or chemicals

Products and Co-Products

Quality and Use

- Gas
 - Producer gas -> Heat/Power
 - Synthesis Gas -> Liquid Fuels
- Oil
 - Fuel->Heat/Power
 - Reprocessing as Chemical feedstock
 - Flavoring and high value uses
- Char
 - Soil Amendment
 - Carbon Products

Small Scale Gasifier CHP

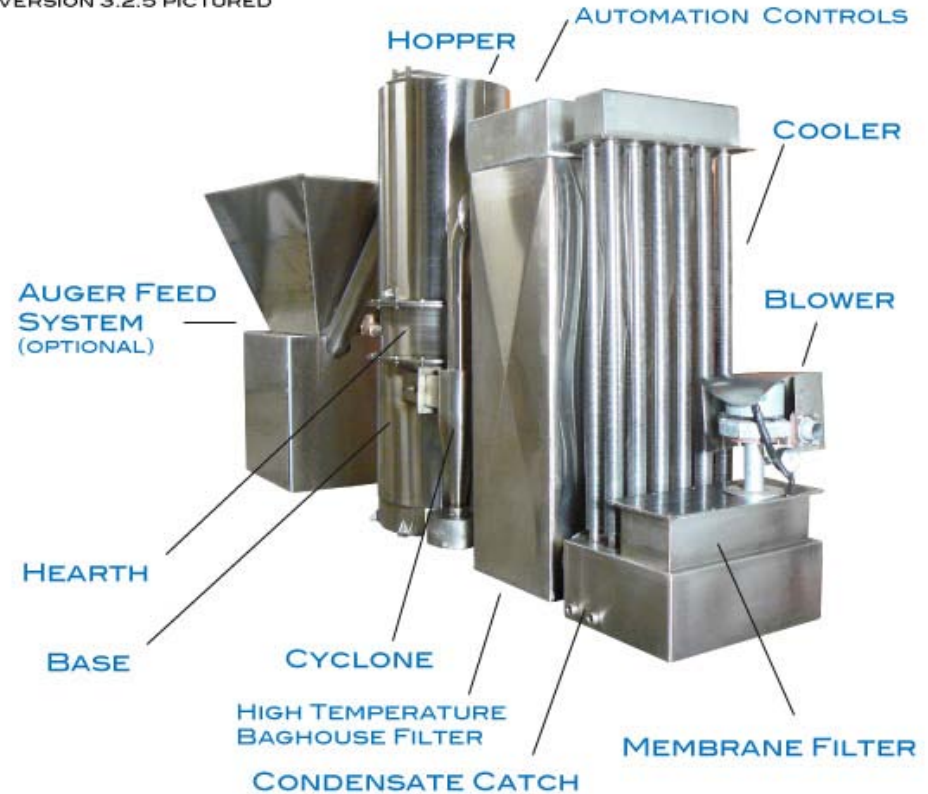
- Origins: Engines in WWII
- Adapted to Stationary Power in 1970-95
- Publically funded demonstration projects- many attempts, few successes
- US RD&D Programs stimulated new interest 2003-2007
- North American rediscovery 2007-2010
- Europe continued R&D. Limited commercial application in CHP, expand scale.



Small Scale Gasification Rediscovered



OFF GRIDDER LAYOUT
VERSION 3.2.5 PICTURED



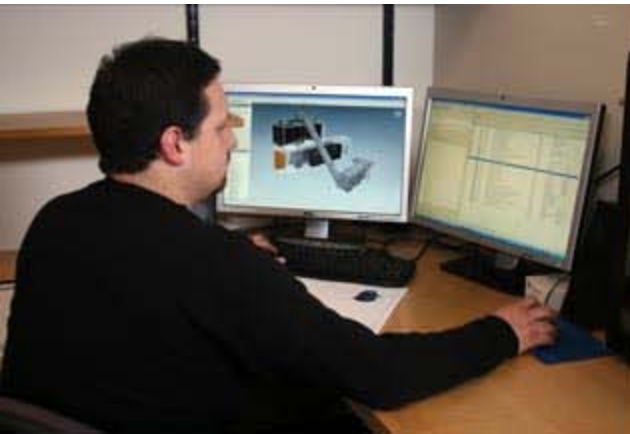
Gasifier Experimenter's
Kit (GEK)
All Power Labs
www.gekgasifier.com

10-30 kW Off Gridder
Victory Gasworks
woodygasifier.com

100 kWe Community Power Corporation Gasifier-Generator



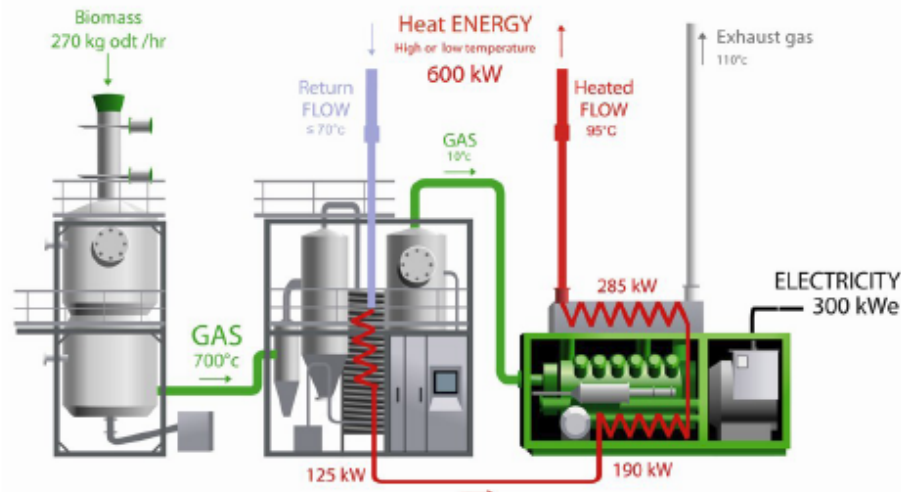
Dixon Ridge Walnut Farm 10,000 hrs CHP
20 + Gasogens 25-100 kWe
Syngas to liquid fuel demo
www.gocpc.com



European Suppliers Expand Small CHP Capacity

Xylowatt NOTAR Gasifier

Combined Heat & Power plant:
heat & electricity (xW300 model)



Global efficiency = 75% (25% electricity, 50% heat)



300 kWe Module

info@xylowatt.com

www.xylowatt.com

XYLOWATT sa

New Suppliers and Technologies for Heat and Power Suitable for Crop Residues



ICM Inc



Wood



Straw



**Seed
Screenings**

**100 kWe 10% Char
Northern Excellence MN
U N Dakota EERC**



**ICM 200 tpd Gasifier
Wood, Straw, Stover
www.icminc.com
Trevor.Hinz@ICMINC.com**

Suppliers Expand Capacity, Fuels, Add Power



Nexterra Gasifiers and Boiler at Hefley Plywood, Tolko, BC (2006)

1. Wood Fuel Bin
2. Gasification Hearth
3. Ash removal
4. Gas exit

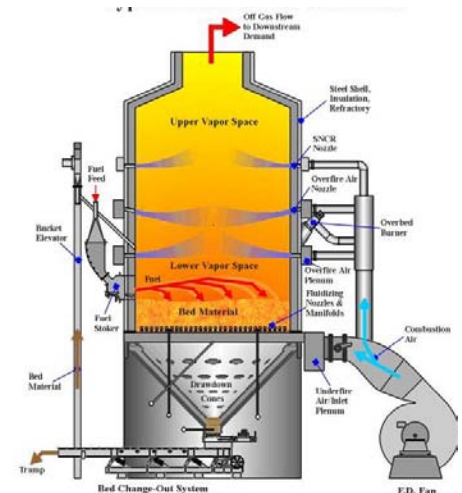
www.nexterra.ca



Energy Products of Idaho Gasifier at BFC Gas & Electric, IA (1998)

- Fluidized Bed gasification
- Staged gasification
- Ag waste fuels

www.energyproducts.com

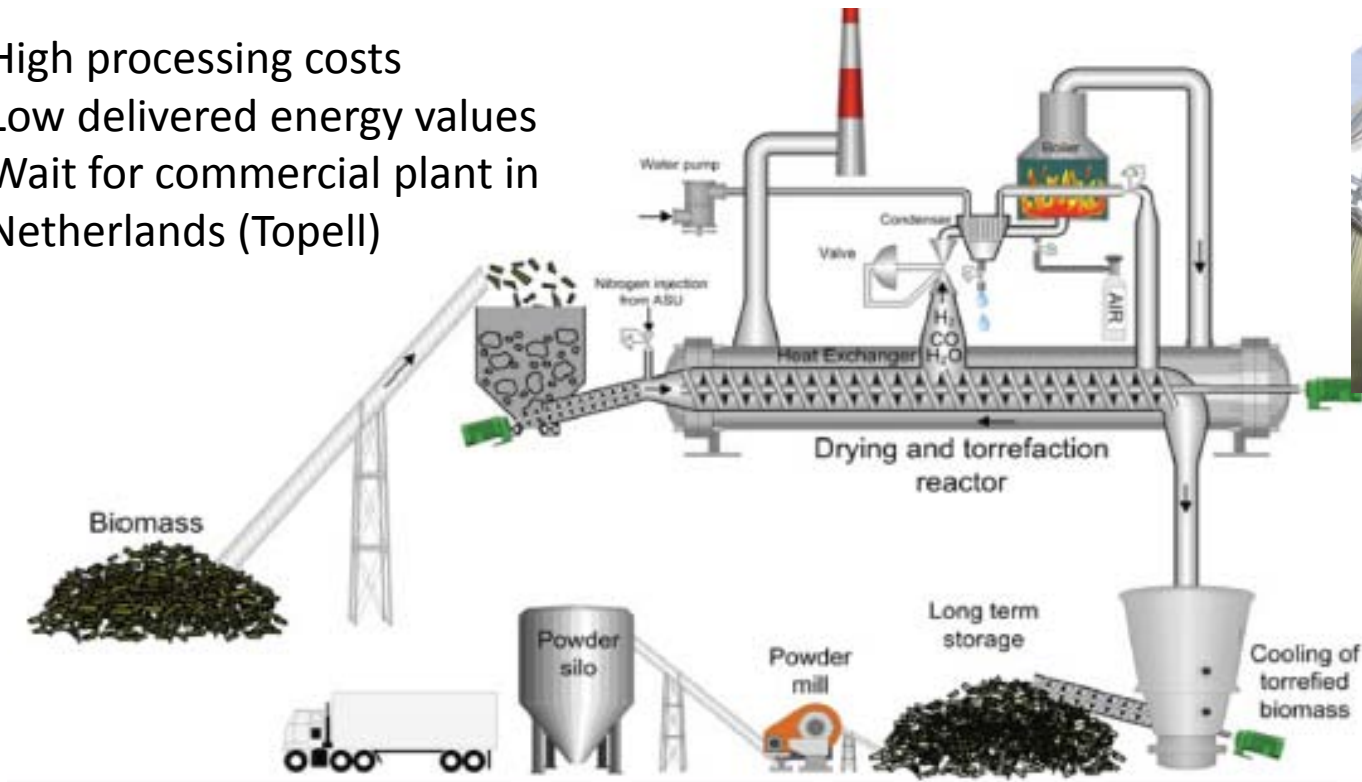


Torrefaction

- Partial carbonization (250 -320 C) to concentrate energy density of biomass.
- Densification for transportation, and handling
- Increased energy density assumed to offset processing losses and costs.

US:

1. High processing costs
2. Low delivered energy values
3. Wait for commercial plant in Netherlands (Topell)



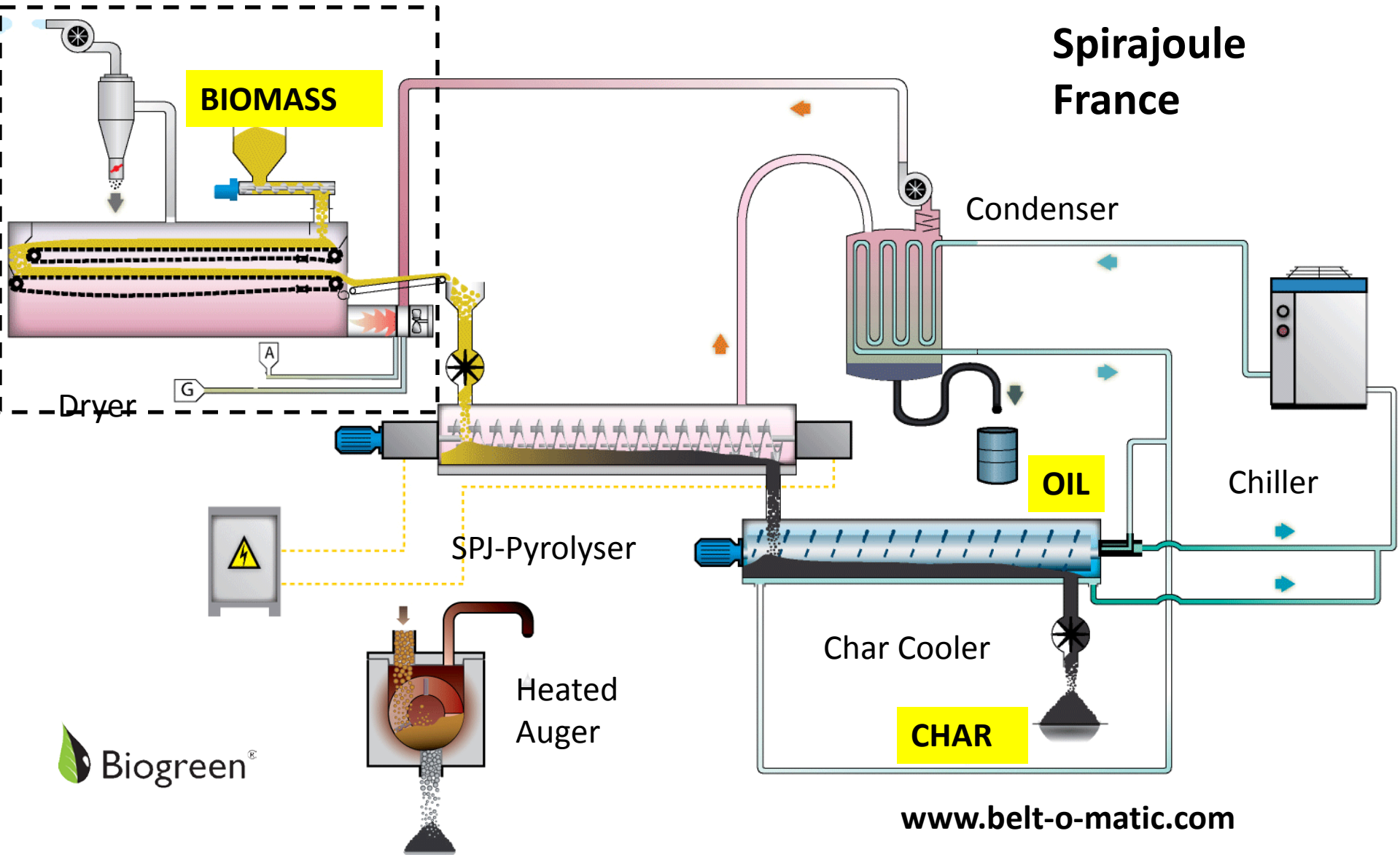
**Torbed Reactor
Polow Energy**

www.wyssmont.com
www.topellenergy.com

Small Scale Pyrolysis Challenges

- Products
 - Oil Characterization and Quality Control
 - Capturing value of co-products (total production)
 - Upgrading oil, catalysts, hydro-processing
- Scale
 - Small production not feasible - revenue/cost
- Process
 - Refined products still in research and development
 - Pretreatment of feedstocks
 - Catalysts development

Pyrolysis to Oil and Char



Farm Scale Mobile Pyrolysis

Decentralized processing – Biocrude
Demonstrated at 200 kg/h – in development



Systems in Demonstration and Development



Advanced Biorefinery 1/2 TPD



**Advanced Biorefinery
Prototype 50 TPD**

- System development 1/2 tpd (25 kg/hr)
- Product development – oil and char

www.advbiorefineryinc.ca

Pyrolysis: JF Biocarbon Systems



Heated Augers

Models to 200 green tpd



Mobil Demo System

JF Biocarbon Systems
jovick@telus.net

Summary

- Small industrial gasification technologies are ready for use in the PNW.
- Biochar can be produced as a byproduct of gasification or pyrolysis.
- Torrefaction is not yet proven commercially in Europe or North America.
- Farm scale pyrolysis technologies are still in development.
- Advanced oil processes have been scaled up to larger industrial production.

gasifiers.bioenergylists.org

TR Miles Technical Consultants, Inc.

1470 SW Woodward Way

Portland, OR 97225

tmiles@trmiles.com

www.trmiles.com

503-292-0107

503-780-8185 mobile

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