



THE PRACTICAL, PROVEN PATH TO GREEN ENERGY.

RTP™ rapid thermal processing from
Envergent Technologies



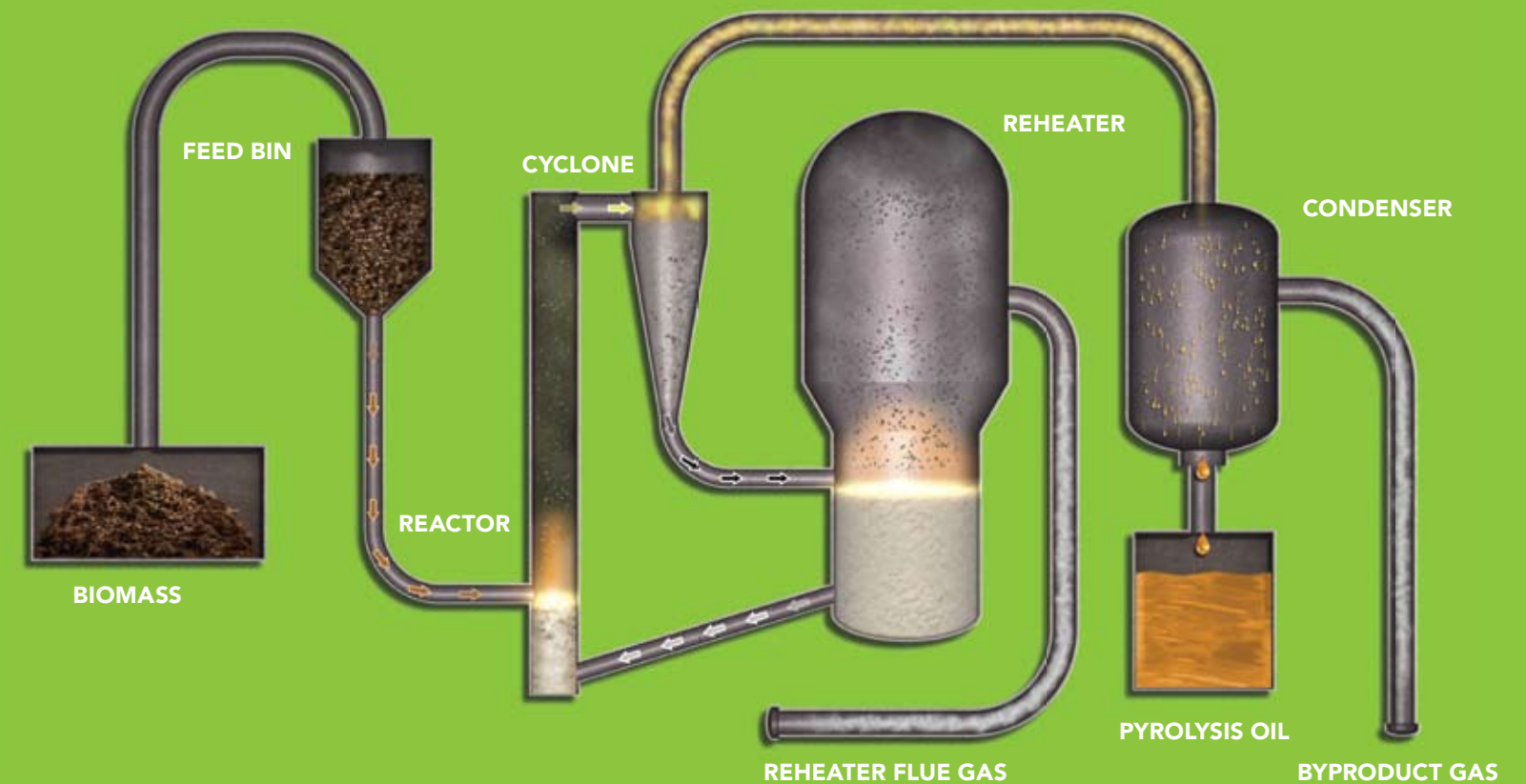
Rapid thermal processing uses readily available, relatively low-cost biomass feedstocks that don't compete with food crops.

RTP CONVERTS BIOMASS TO PYROLYSIS OIL FAST.

Less than two seconds. That's all the time it takes to convert biomass into pyrolysis oil using rapid thermal processing.

During the process, biomass is heated rapidly to approximately 500°C in the absence of oxygen. A circulating transported fluidized bed reactor system similar to the one used in the UOP Fluid Catalytic Cracking (FCC) technology is at the heart of the process.

A tornado of hot sand vaporizes the biomass, which is then cooled rapidly, typically yielding 65 to 75% pyrolysis oil. This pourable liquid can then be used as fuel for heat or electricity generation or upgraded to green transportation fuels.



RTP YIELDS

Rapid thermal processing quickly converts a wide range of biomass feedstocks into high-value pyrolysis oil. This lignocellulosic biomass is readily available and does not compete with food crops, making it ideal feedstock for green energy conversion.

BIOMASS MATERIAL	YIELD (WT%)	HIGHER HEATING VALUE (BTU/LB)
Hardwood	70-75	7,400-8,200
Softwood	70-80	7,300-8,000
Hardwood Bark	60-65	7,180-8,680
Softwood Bark	55-65	7,180-8,500
Corn Fiber	65-75	7,570-8,680
Bagasse	70-75	8,100-8,200
Waste Paper	60-80	7,300-7,400

RTP™ RAPID THERMAL PROCESSING CONVERTS LOW-VALUE BIOMASS INTO A HIGH-VALUE LIQUID ASSET—PYROLYSIS OIL.

Today, one company, Envergent Technologies, offers a practical and commercially proven path to green energy. This advanced technology is called RTP, or rapid thermal processing.

RTP is used to convert cellulosic biomass feedstock, usually forestry or agricultural residuals, into pyrolysis oil—a light, pourable, clean-burning liquid. Pyrolysis oil provides a sustainable, cost-effective and virtually carbon-neutral alternative for process heat, power generation and, with further refining, transportation fuels.

Envergent is backed by more than a century of energy industry experience

Envergent Technologies is a joint venture between two recognized energy leaders—**Ensyn Corp.** and **UOP, a Honeywell Company.**

Ensyn, headquartered in Renfrew, Ontario, Canada, was incorporated in 1984 to commercialize RTP, its proprietary biomass-to-liquid technology. It remains

the world's only rapid pyrolysis process operating on a long-term, commercial basis.



To date, Ensyn has designed and built seven commercial RTP plants in the United States and Canada. These plants currently convert biomass to pyrolysis oil for use in the manufacturing of more than 30 commercial products ranging from food flavorings to adhesive resins for construction. Co-products are also used in a variety of commercial thermal applications.



For almost a century, Honeywell's UOP has been delivering cutting-edge technology and products to the refining, petrochemical and gas processing industries. Today, 60% of the world's gasoline and 85% of biodegradable detergents are produced using UOP processes.

In 2006, UOP formally launched its efforts to develop and commercialize efficient and profitable technology that converts biological feedstocks into valuable, green biofuels and chemicals. UOP's focus is on technology to produce drop-in fuels that utilize existing refining infrastructure and technology. Today, it offers multiple technologies for the production of green transportation fuels.



Pyrolysis oil is pourable, making it easy to store and transport for use when and where it's needed.

DRAMATICALLY REDUCE GREENHOUSE GAS EMISSIONS

Pyrolysis oil created by rapid thermal processing contains almost no sulfur and is virtually carbon-neutral. It can be easily adapted for use in a wide variety of industries including pulp and paper, refining and petrochemicals, electrical generation and most energy-intensive heavy industry.

RTP is virtually self-sustaining, using the byproducts produced to generate much of the heat and power required to operate the unit. The process produces char, which is consumed internally to generate the required heat for the process. Another byproduct is gas, which can be used to dry the incoming biomass or for heat integration into the overall facility. These features are a distinct benefit for companies looking to reduce their greenhouse gas emissions.

RTP versatility makes green energy practical. Today.

Aside from its many environmental advantages, rapid thermal processing is also very practical. Minimal utility and infrastructure requirements make RTP ideal

for remote or existing facilities. Compact, modular equipment minimizes installation costs and takes up relatively little space. And it's highly scalable—designs from 100 to 1,000 bone dry tonnes (metric) per day accommodate virtually any application.

RTP can also handle a wide range of readily available feedstocks—forestry and agricultural residuals, post-consumer, wood-based construction and demolition materials as well as sustainable energy crops such as poplar and willow, miscanthus and switchgrass.

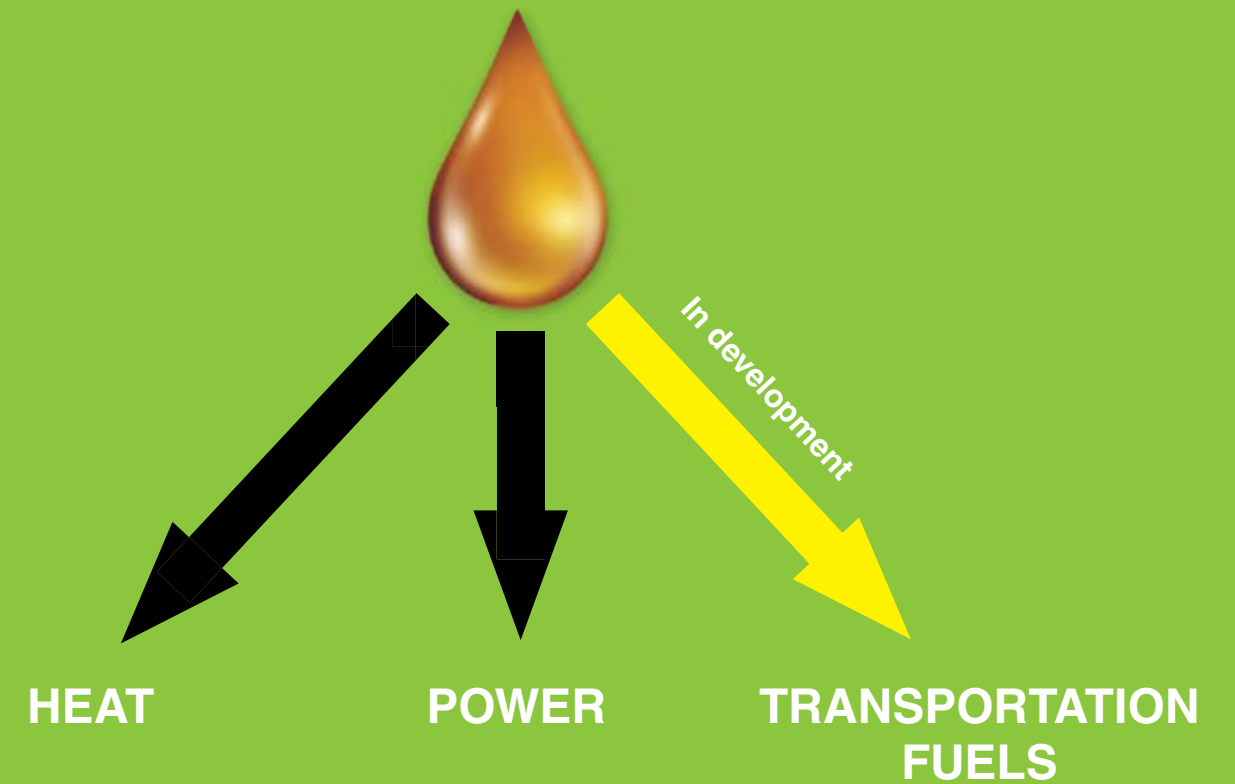
All of which makes RTP a proven, practical way to reduce your company's carbon footprint. Starting today.

RTP PYROLYSIS OIL VERSUS...

Direct Combustion

This alternative captures considerably less energy than RTP. Burning residuals results in more variable energy production than burning more consistent, energy-dense pyrolysis oil. And with direct combustion, once feedstock conversion begins, the energy must be used immediately on-site, unlike pyrolysis oil, which can easily be stored for later use or transported to another facility.

PYROLYSIS OIL



On an equivalent energy basis, it's about 40% less expensive to produce and use pyrolysis oil than to purchase #2 fuel oil for heat generation.* In addition to saving money, pyrolysis oil also helps save the environment by reducing greenhouse gas emissions 70 to 90%.

Green electricity produced with pyrolysis oil costs approximately \$0.10 per kWh.** Pyrolysis oil has proven compatible with specialized turbines and is currently used as a blend with fossil fuel in stationary diesel engines. Generating electricity with 100% pyrolysis oil is under development.

Pyrolysis oil can be upgraded to green transportation fuels using established UOP hydroprocessing technology. The process yields high-value, renewable, green gasoline, diesel and jet fuel. The fuels perform better than their petroleum counterparts and use existing refining infrastructure and fleet technologies.

*Assumes \$60/bbl crude, 400 BDMTPD RTP Unit, 15-yr. straight line depreciation of CAPEX, 330 days/yr. use
 **Includes RTP operating costs, 15-yr. straight line depreciation of CAPEX (including gas turbine)



RTP equipment is compact, modular in design and scalable to meet the needs of virtually any size operation.

Gasification

The processes associated with gasification are, themselves, energy-intensive. Gasification occurs as a result of high temperatures and high pressure, unlike RTP fast pyrolysis, which requires lower temperature and pressure, making it considerably less expensive to build and operate. Gas produced is less flexible than pyrolysis oil because it is not transported as easily. Gases must be used where and when they are produced. Today, industrial-scale gasification operations for conversion of biomass-to-fuel are still in development.

Pelletization

Wood pellet stoves have gained some popularity for residential use, but the technology has yet to prove

economically viable for commercial applications. While initial capital investment for pelletization is relatively low, the return on investment is notably higher with RTP technology. Pelletization is another form of direct combustion with the same shortcomings. Because the energy produced cannot be transported or stored, market options are reduced. Additionally, many users find the liquid pyrolysis oil produced in the RTP process easier to manage than a solid.

Learn more about the advantages of RTP technology for your business.

Visit our website, EnvergentTech.com, for complete information including an animated diagram of our process as well as a video of our facilities in Renfrew.



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