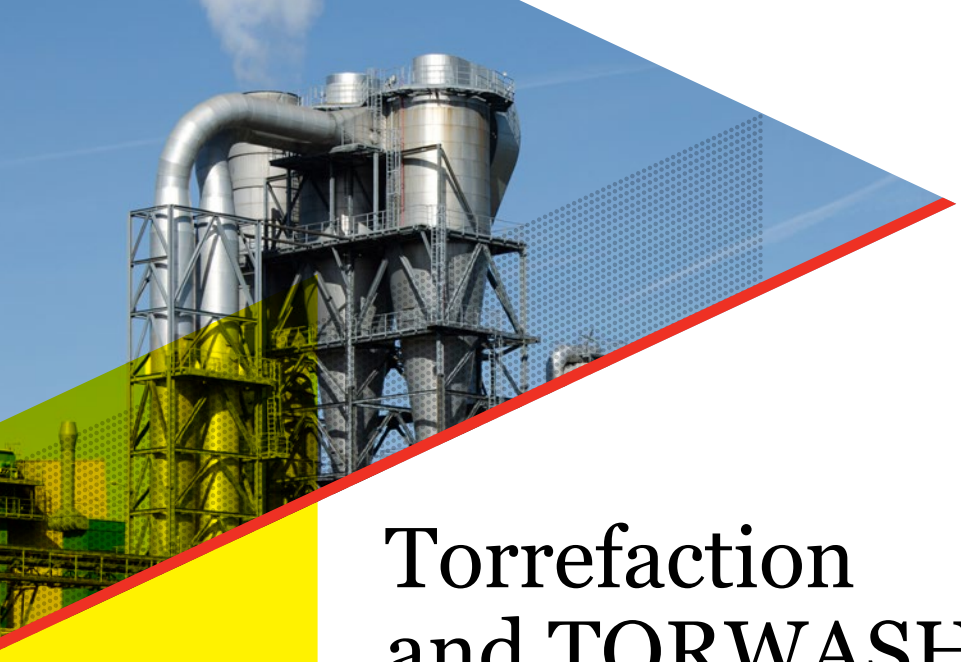

Torrefaction and TORWASH

High-quality solid bioenergy carriers

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ECN has been developing solutions for biomass co-firing in pulverised coal boilers for more than 25 years, and we have played a pioneering role in developing torrefaction technology. Co-firing is expected to play a dominant role in the pursuit of renewable energy targets worldwide. Technology developments at ECN are focused on upgrading biomass streams to allow the use of existing infrastructure and assets, thereby reducing additional capital and operational expenditures to a minimum. Through in-depth knowledge of thermochemical conversion processes, including combustion and gasification of solid fuels, we have a clear understanding of the end-user requirements of upgraded biomass.

What can ECN do for you?

- Assess biomass streams and provide dedicated upgrading solutions for production of solid bioenergy carriers
- Characterise biomass before and after upgrading
- Jointly develop processes for upgrading biomass streams
- Assess upgraded biomass streams and mitigate risks during logistics and conversion

Experience at work

ECN is involved in several national and international projects, where -together with commercial partners- important aspects of the upgraded biomass value chain are investigated. On-site consultancy is provided in conjunction with contract R&D, through dedicated upgraded biomass lab tests. This approach was used during co-gasification trials at NUON/Vattenfall's Buggenum IGCC, and during the co-firing trial with 2300 tons of torrefied pellets in RWE/Essent's AMER-9 power plant. Recently, a successful co-firing trial of ECN/Andritz torrefied pellets was conducted at DONG Energy's Studstrup power plant, where 200 tons torrefied pellets were pulverised in a dedicated roller mill and combusted in an opposed wall fired boiler.

Torrefaction

Torrefaction is a thermochemical biomass upgrading process that takes place at temperatures between 250-300°C in an inert atmosphere. The biomass is converted into a brittle and hydrophobic intermediate. This material is conditioned and densified through pelleting or briquetting, to create a high-quality product that is tailored to replace fossil fuels in existing logistic chains and thermal conversion processes. Torrefaction testing at ECN ranges from milligram-scale batches up to a throughput of 50 kilograms per hour, and can be conducted under well-defined conditions. ECN's torrefaction technology has been licensed to Andritz Pulp & Paper. This partnership has led to a fully operational torrefaction demonstration plant in Sønder Stenderup, Denmark; Andritz is ready for commercial market introduction.

TORWASH

TORWASH, or wet torrefaction, is a hydrothermal treatment step for herbaceous biomass, which is performed under pressure at temperatures between 150 and 250°C. TORWASH is particularly suited to upgrading feedstocks with undesirable characteristics, such as: high moisture and ash content, fibrous composition, and low bulk density. TORWASH alters the structure making the fibres more brittle, while water that permeates the biomass typically dissolves more than 98% of the chloride and alkali salts. The treated biomass can be mechanically dewatered, which minimises the need for thermal drying. TORWASH testing facilities at ECN range up to a few kilograms per batch, and a pilot installation is planned in 2014. Recently TORWASHed and densified biomass streams demonstrated compliance with the ENplus A1 quality standard.

ECN: Solution Provider

ECN has extensive experience in characterisation and assessment of upgraded biomass: torrefaction, TORWASH, steam explosion, hydrothermal upgrading, biochar, etc. Our lab infrastructure is tailored to test upgraded biomass under conditions that are relevant for commercially operated processes. Together with our in-depth knowledge of logistic chains and thermal conversion processes, this approach simultaneously provides solutions and mitigates risks, at affordable costs.

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