

Ministry of the Environment Nano Cellulose Promotion



Kyoto Process 4th Generation - Shaping the Future of CNF with High-Efficiency Reactive Processing -

Toward a society that leverages the blessings of forest resources to strengthen industrial competitiveness and create environmental value

Cellulose nanofiber (CNF) is a lightweight and high strength material derived from wood. The “Kyoto Process 4th Generation,” developed by Kyoto University, employs a new method in which pulp is directly kneaded with resin for modification and nano fibrillation. This approach reduces the conventional four manufacturing steps to two, enabling low cost, low CO₂, and large-scale production. Wider adoption of CNF produced through this technology will increase CO₂ absorption and storage as a renewable forest resource. Products made with CNF can be made lighter, and it has been shown, for example, to improve fuel efficiency in automobiles. In addition, reducing the use of fossil-resource-based resins contributes to CO₂ reduction across the entire product life cycle.

NCP Supports LCA

Case Examples of Product Commercialization Enabled by LCA Evaluation

Yoshikawa Kuni Kogyo Co., Ltd.
“Stack-Up Container”

Effect of Weight Reduction on CO₂ Emissions



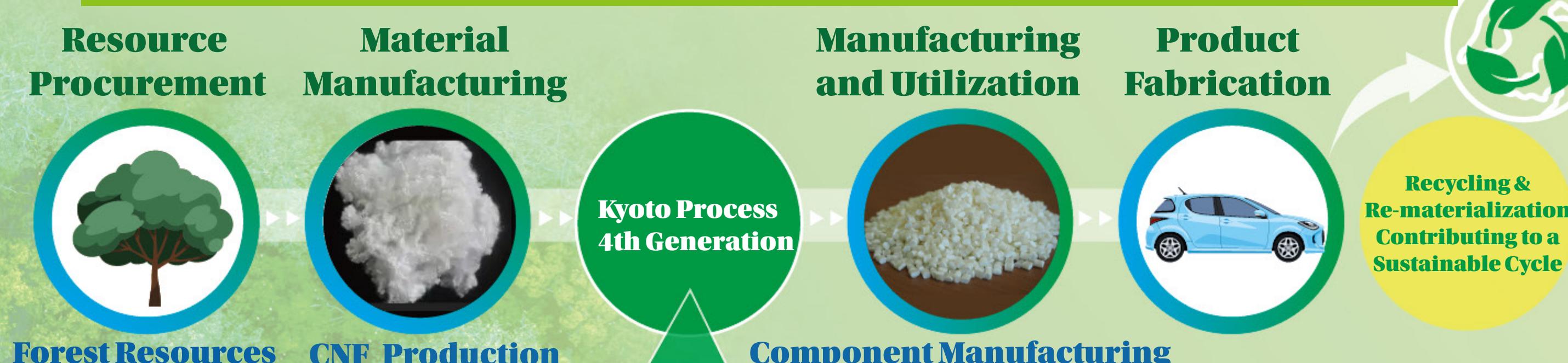
VeSS CO., LTD.
“Brush / Comb”
CO₂ Reduction through
Resin Replacement (ABS → PP)



If you are interested in CNF, please feel free to contact us.

The Sustainable Circular System Enabled by CNF

From Forest to Products — The 4th-Generation Process Flow



Conventional Process

1 Modified Pulp Production 2 Pre-Mixing 3 Resin Compounding 4 Masterbatch Dilution

Reinforced resin manufacturing shortened from 4 steps to 2

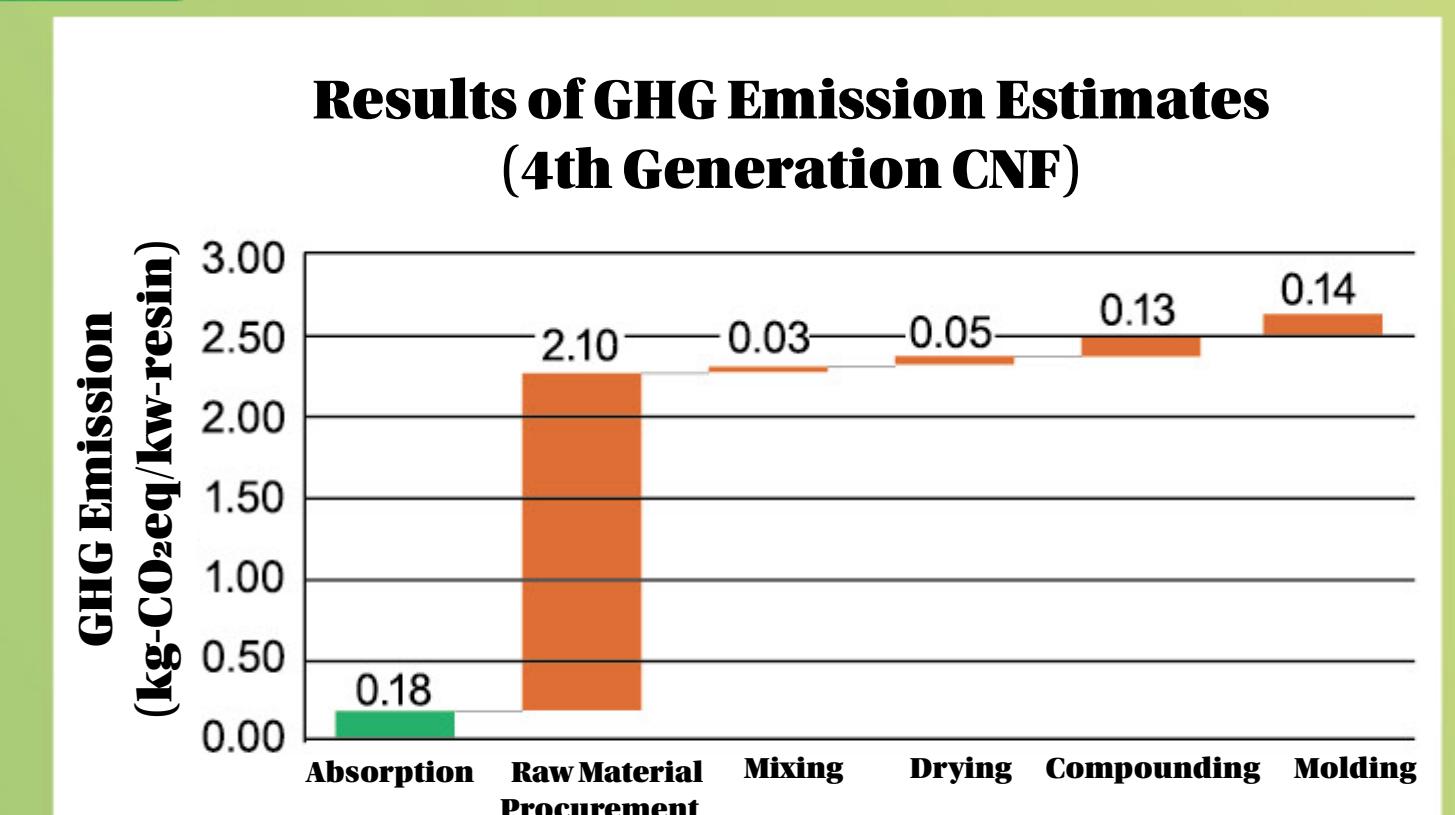
enabling low cost, low CO₂, mass production processing.

Kyoto Process 4th Generation

1 Pre-Mixing 2 Reactive Compounding Process

From Forest to Products CNF's Life Cycle CO₂ Reduction Potential

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The GHG emissions of the resin produced through this technology (hereafter referred to as 4th-generation CNF) were estimated as shown above. Because this CNF is made from forest resources that absorb CO₂, it contributes to GHG reduction through CO₂ absorption and sequestration. Beyond satisfying the required performance of end users and final products, it also allows for assertions of GHG reductions based on the proportion of CNF blended. The “Kyoto Process 4th Generation” is recognized as an emerging material technology that supports a sustainable society.