Wood is good
..but can we make better use of it?

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Department for Geosciences and
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The forest as carbon sink and biomass factory

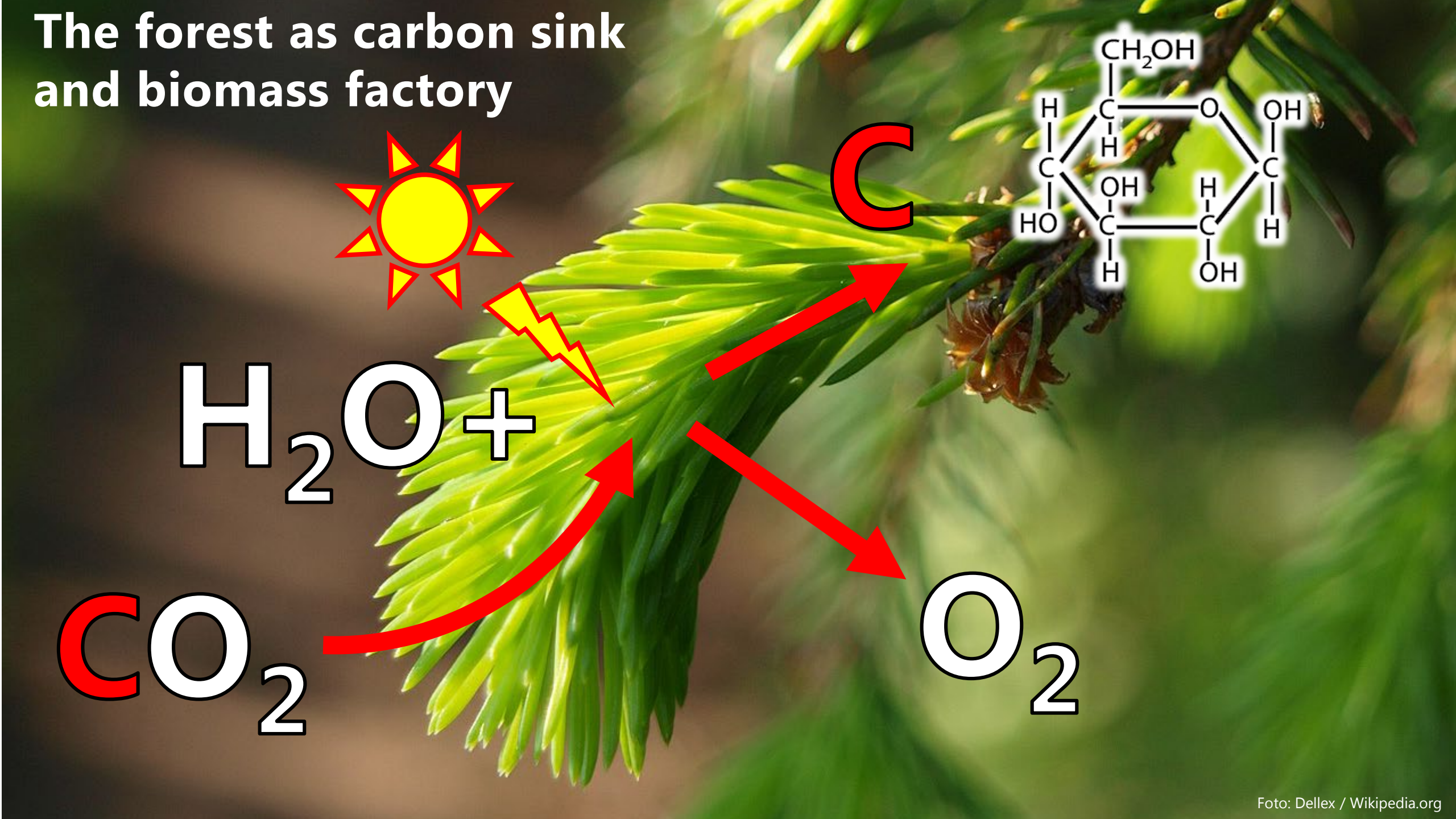
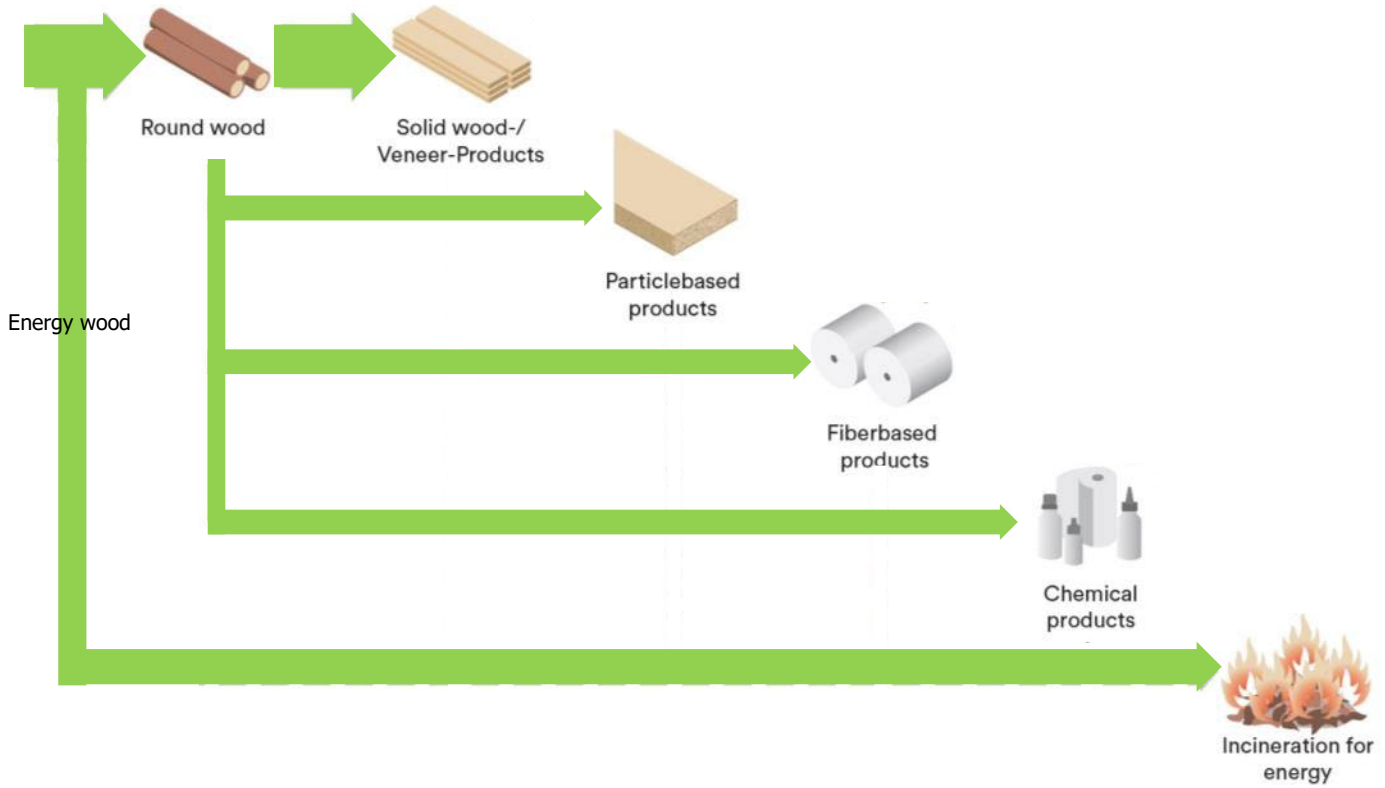


Foto: Dellex / Wikipedia.org

AGENDA

- WHAT IS WOODY BIOMASS USED FOR?
- COULD WE MAKE BETTER USE OF WOODY BIOMASS?

What is woody biomass used for?



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Hughes (2019) https://doi.org/10.1515/9783035617061-002
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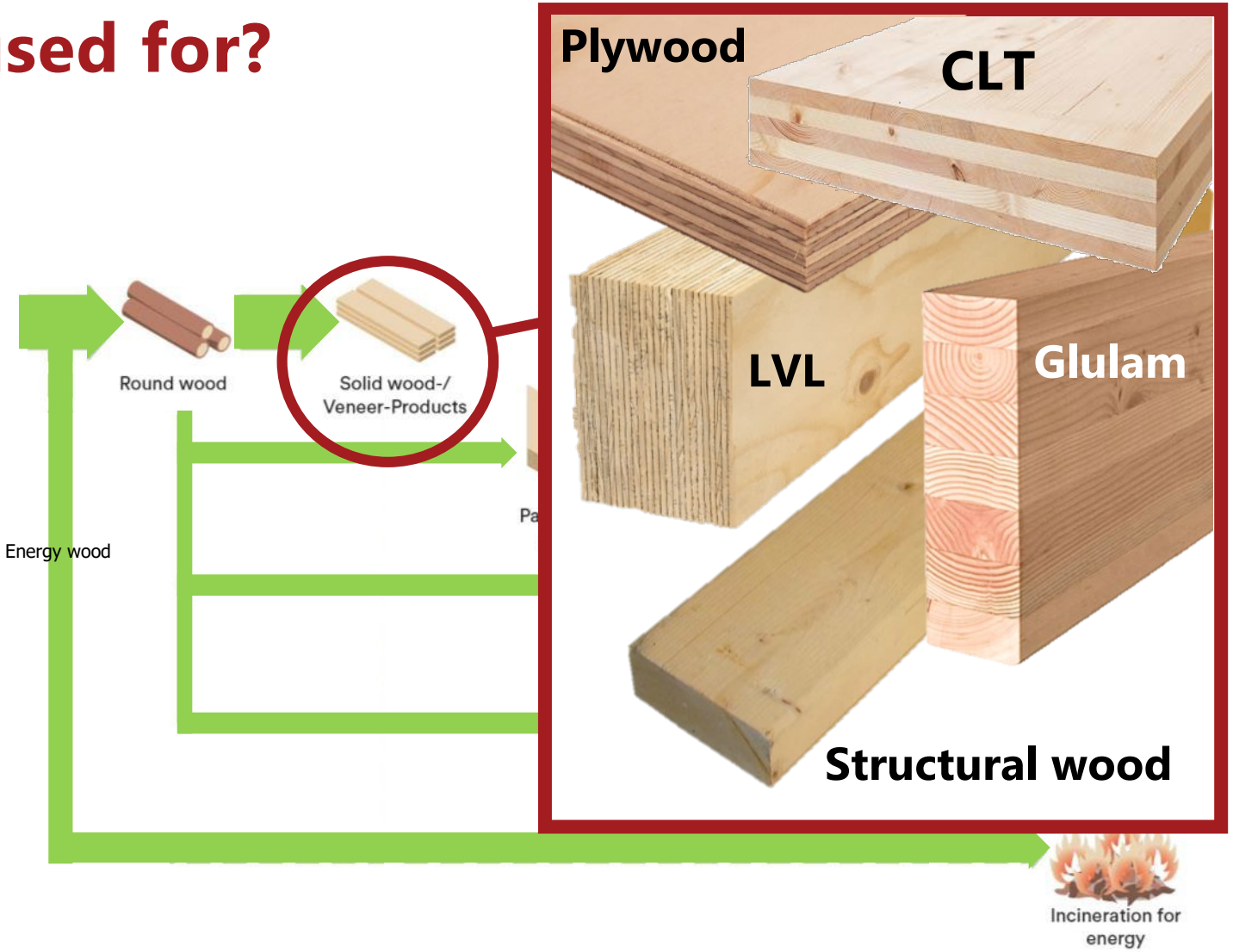

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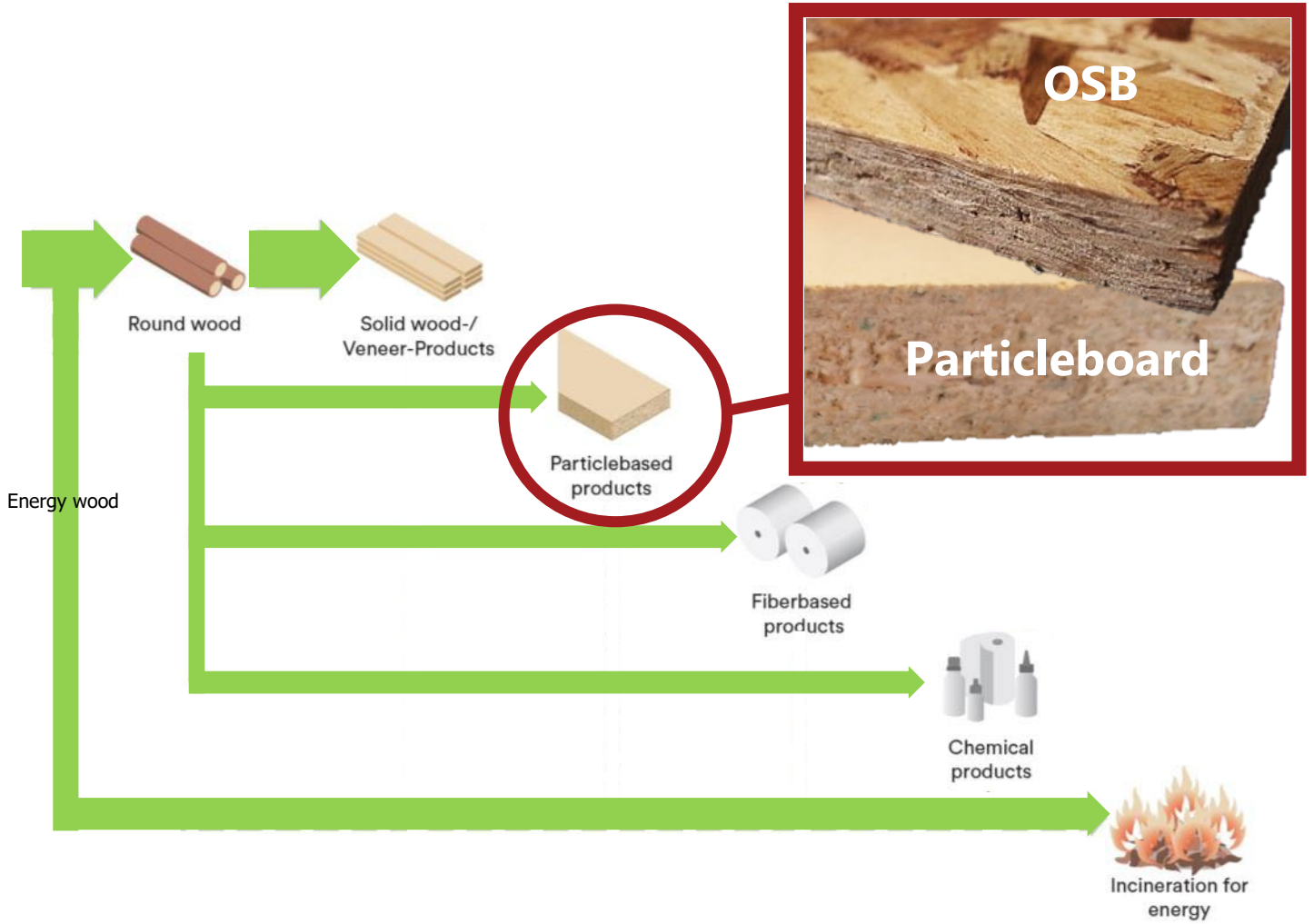

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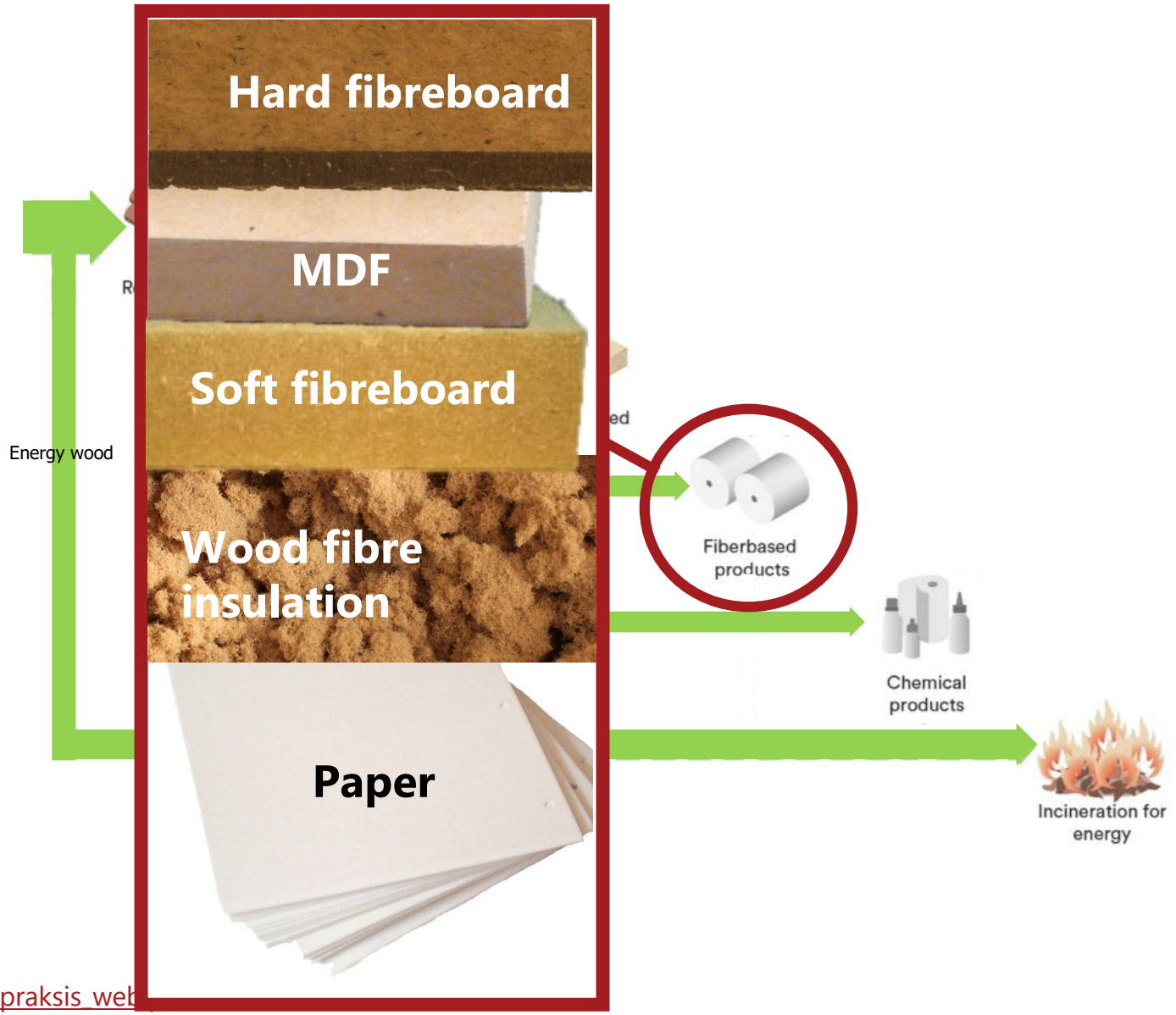

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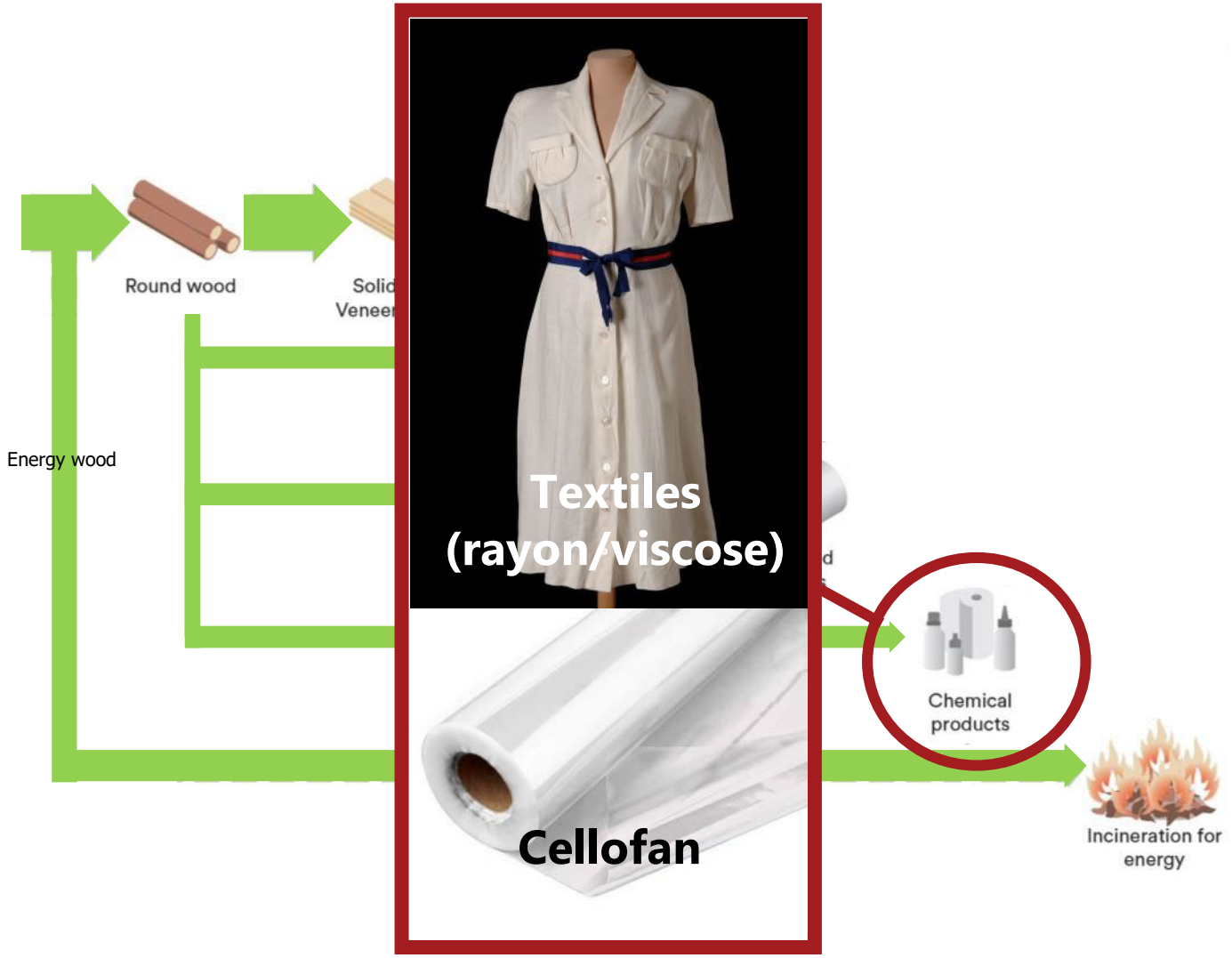

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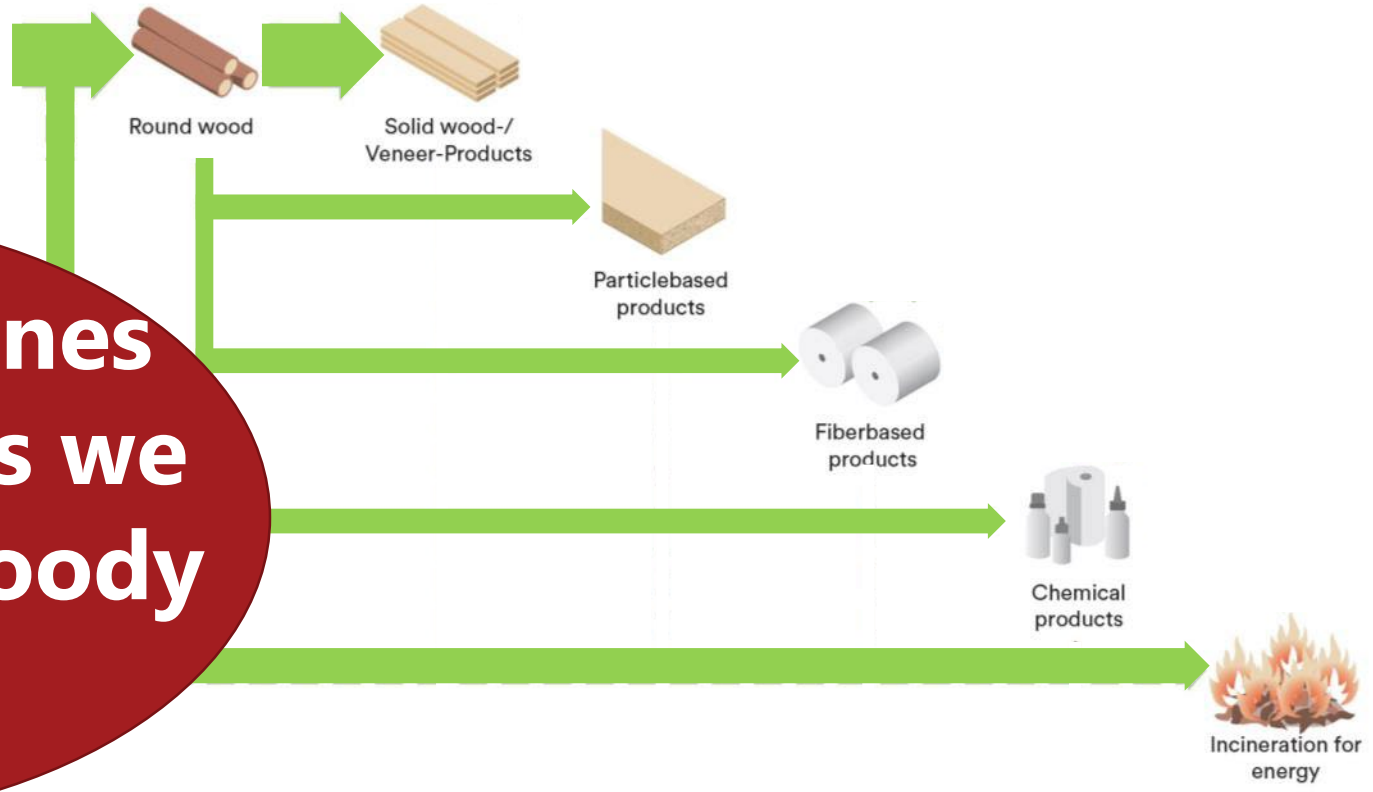
What is woody biomass used for?

What determines which products we make out of woody biomass?



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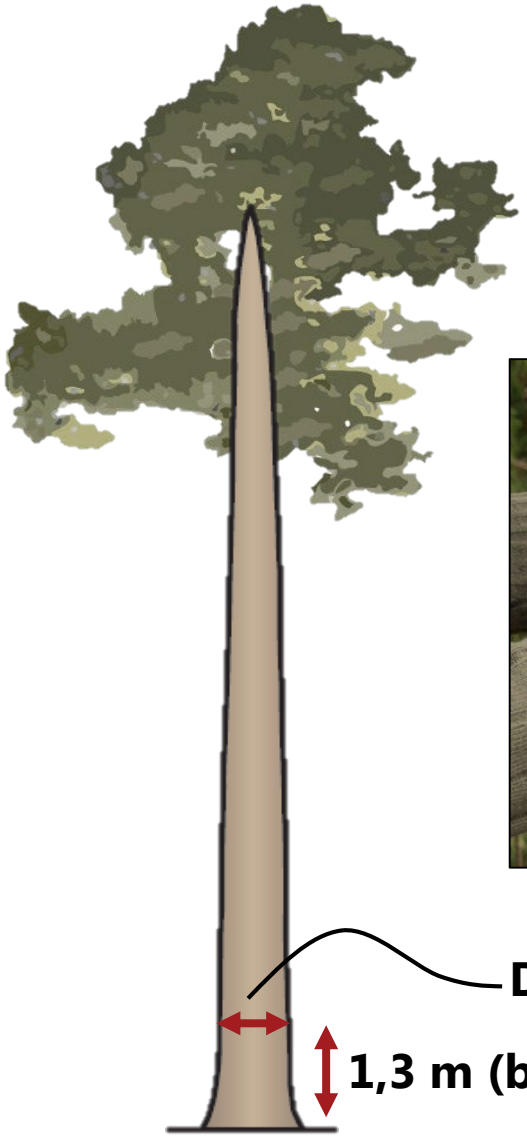
What determines which products we make?



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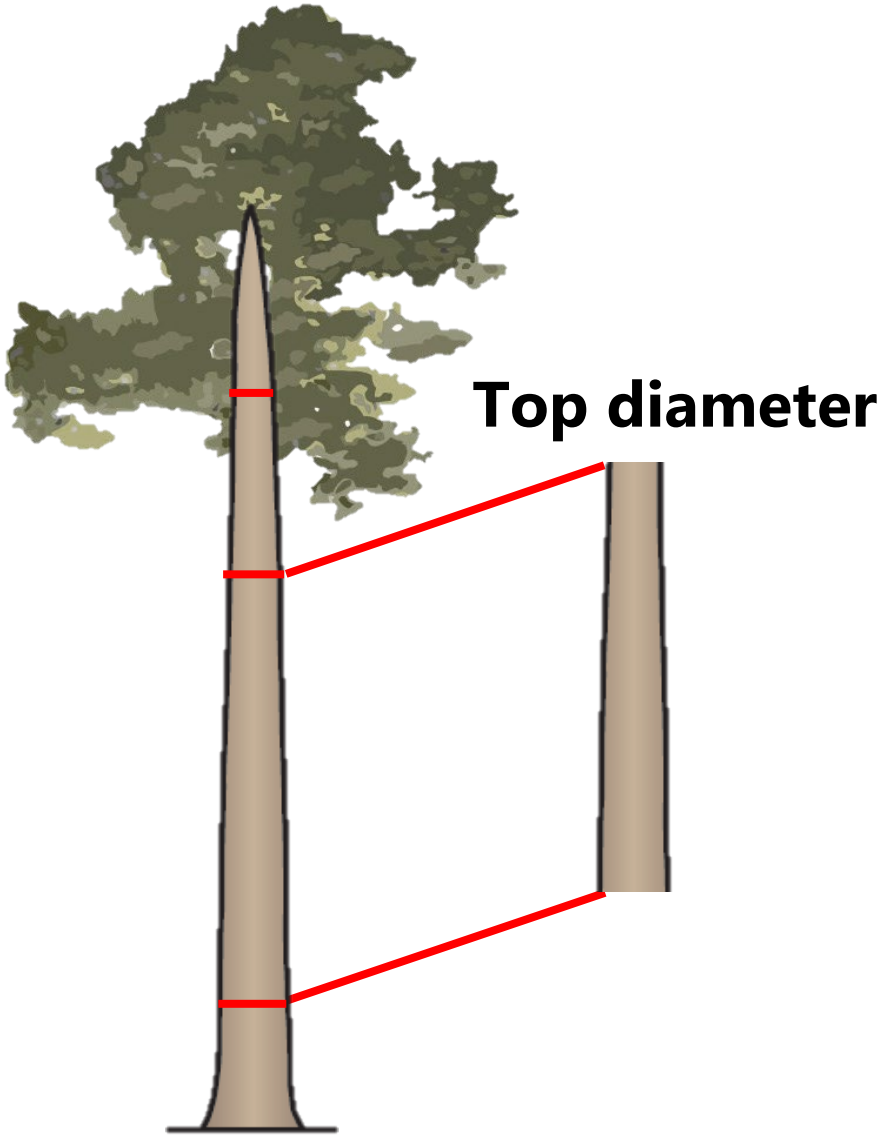
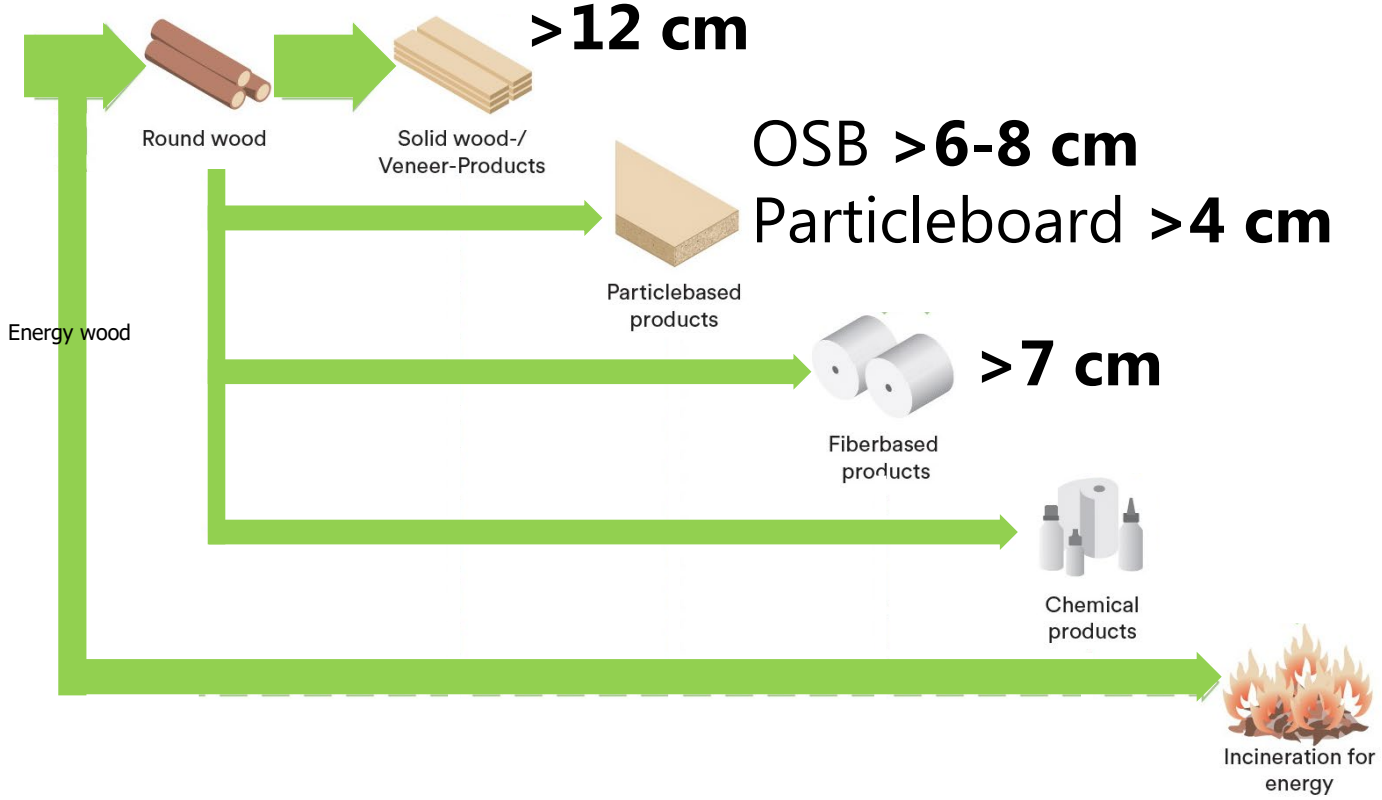


Required top diameter



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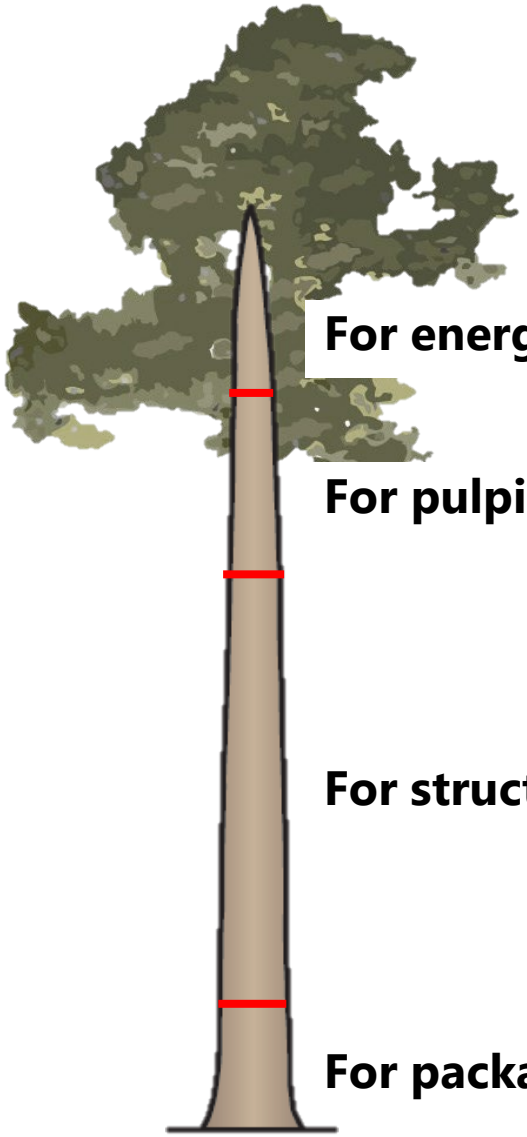


For energy (~5 %)

For pulping (~10 %)

For structural wood (~70 %)

For packaging (~10-15 %)

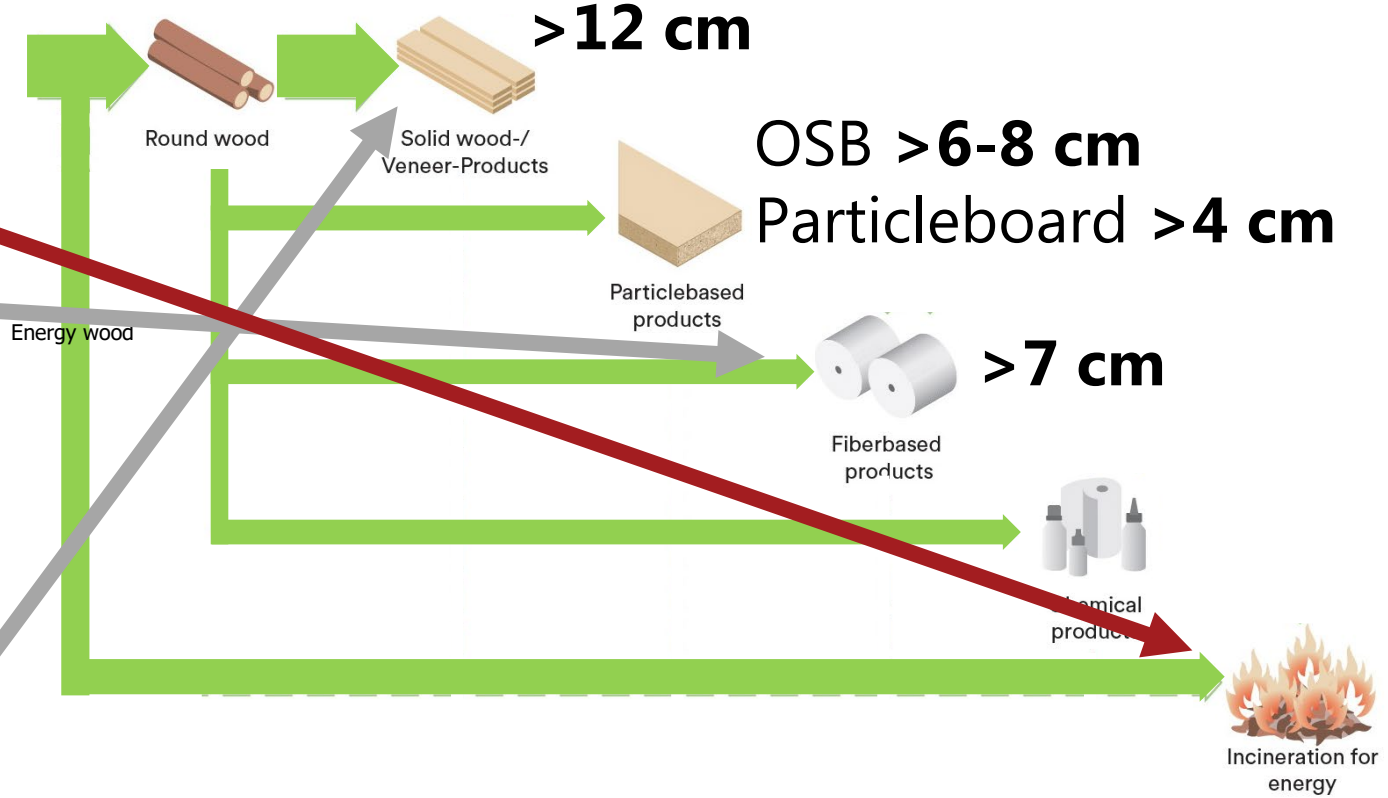
Required top diameter

>12 cm

OSB **>6-8 cm**

Particleboard **>4 cm**

>7 cm



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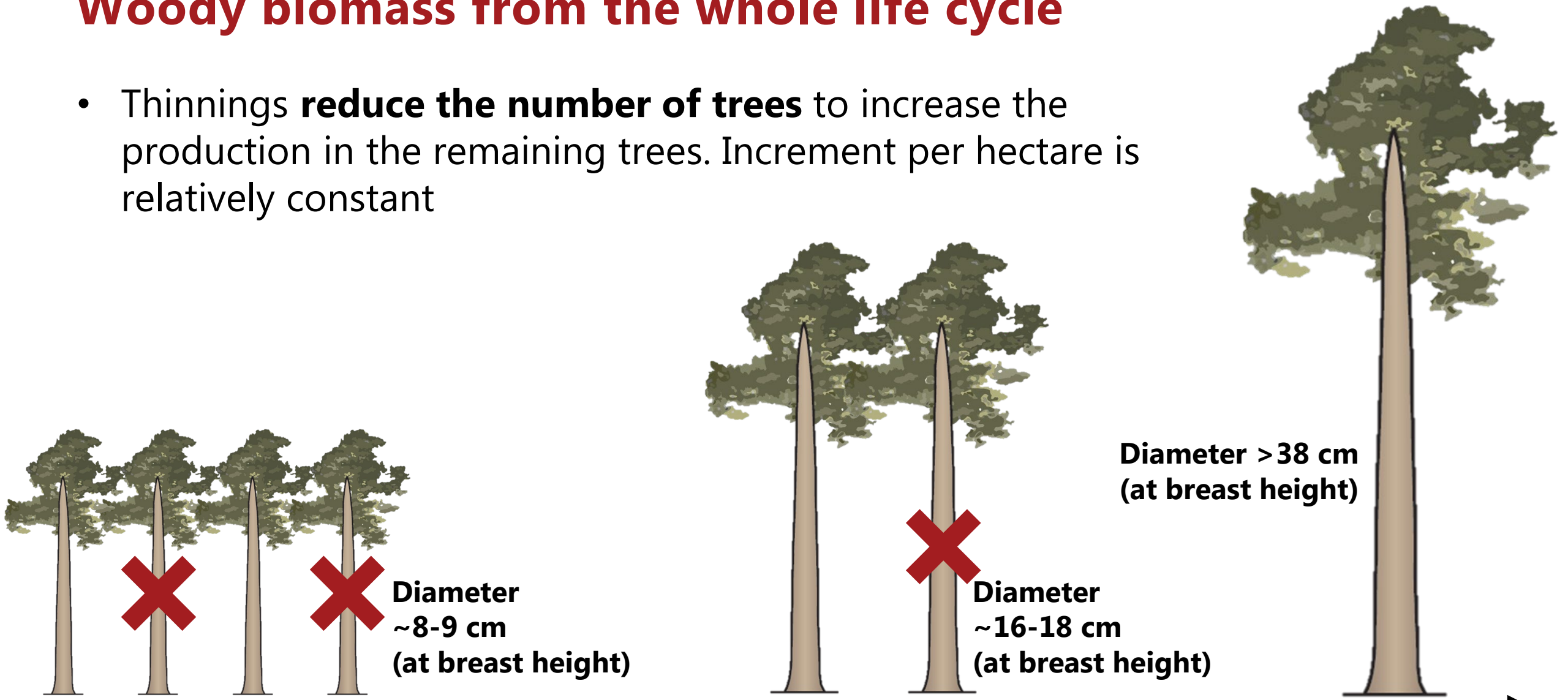
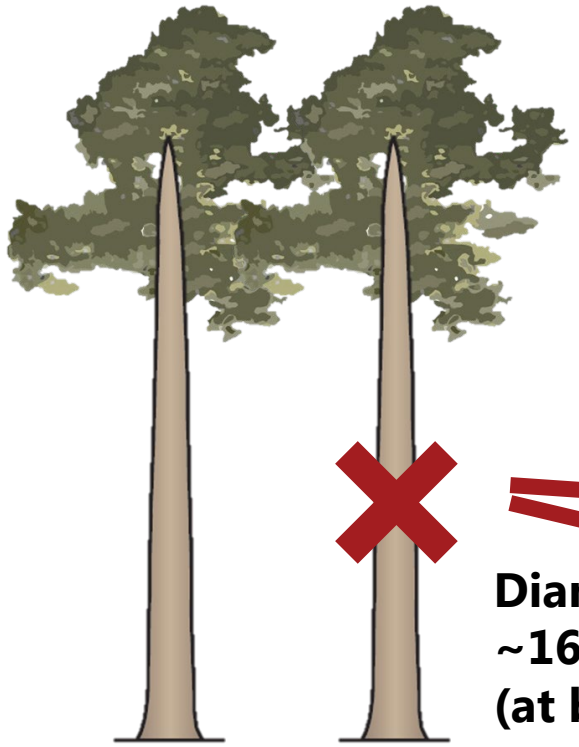
Woody biomass from the whole life cycle

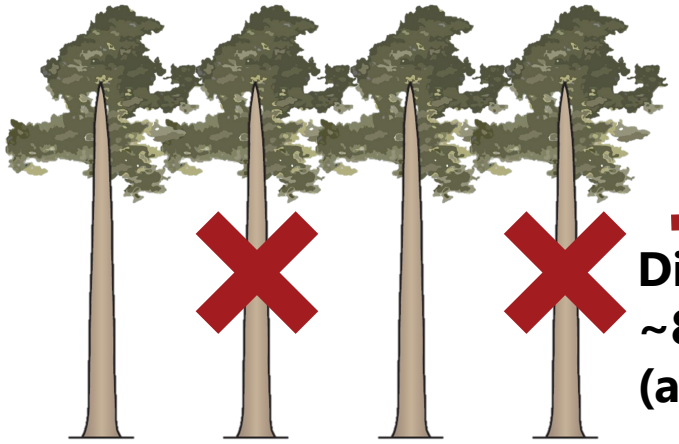
- Thinnings **reduce the number of trees** to increase the production in the remaining trees. Increment per hectare is relatively constant



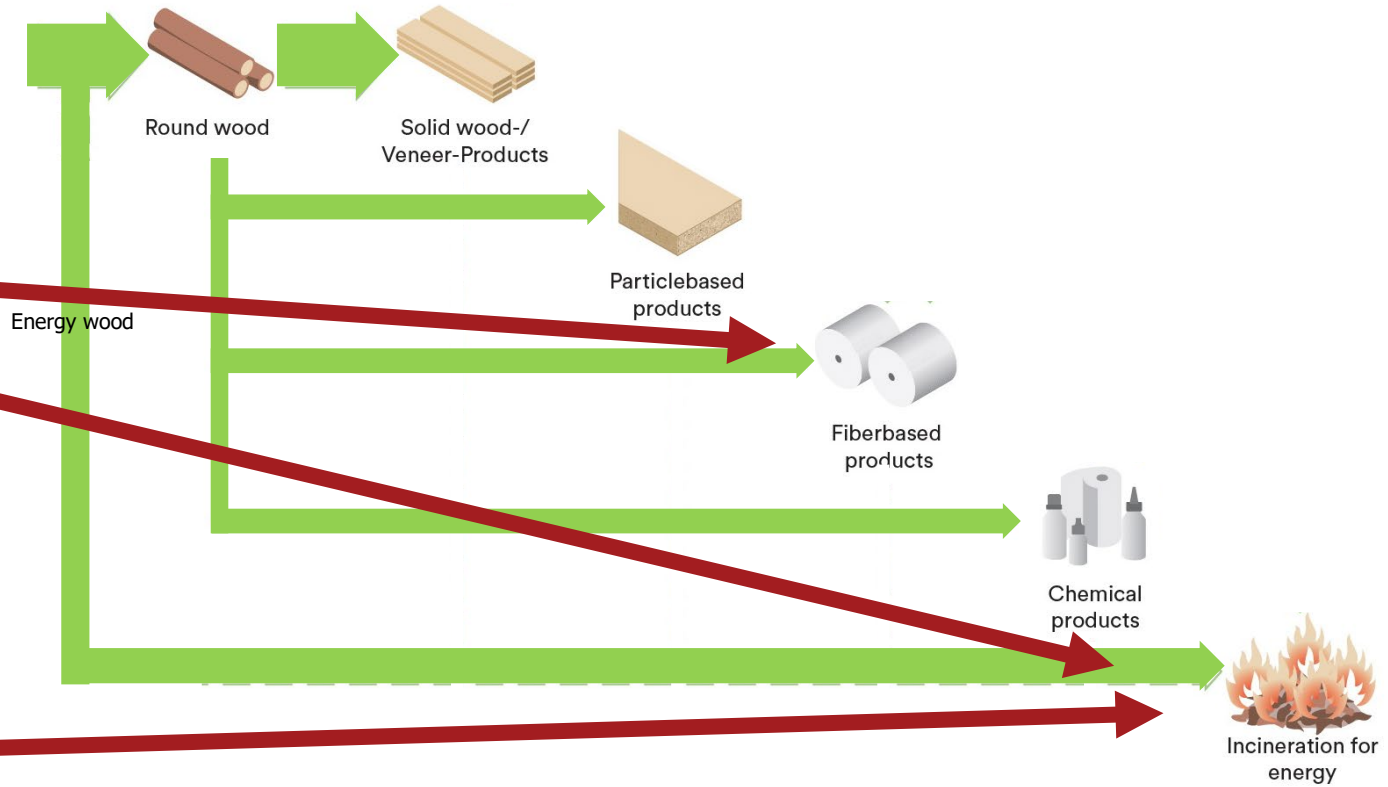
Products made from woody biomass from thinnings



Diameter
~16-18 cm
(at breast height)



Diameter
~8-9 cm
(at breast height)



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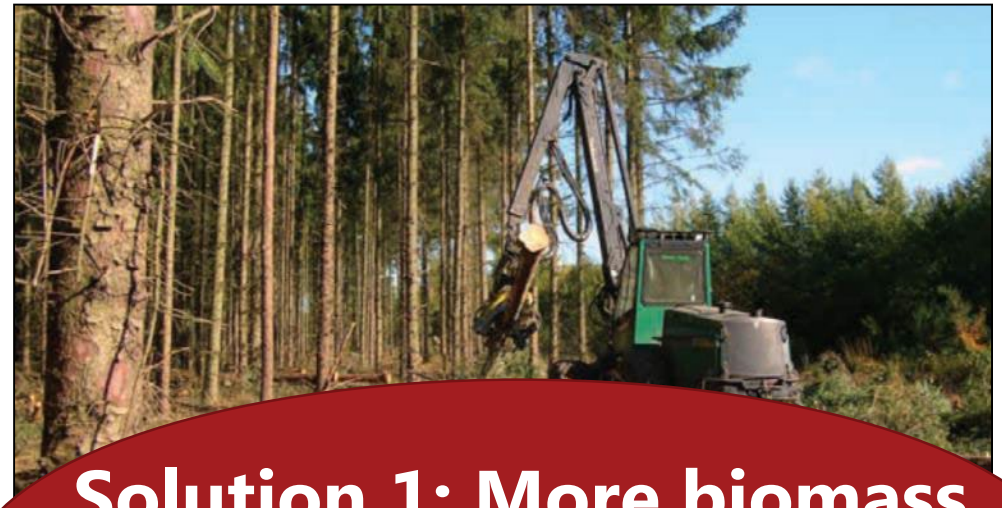
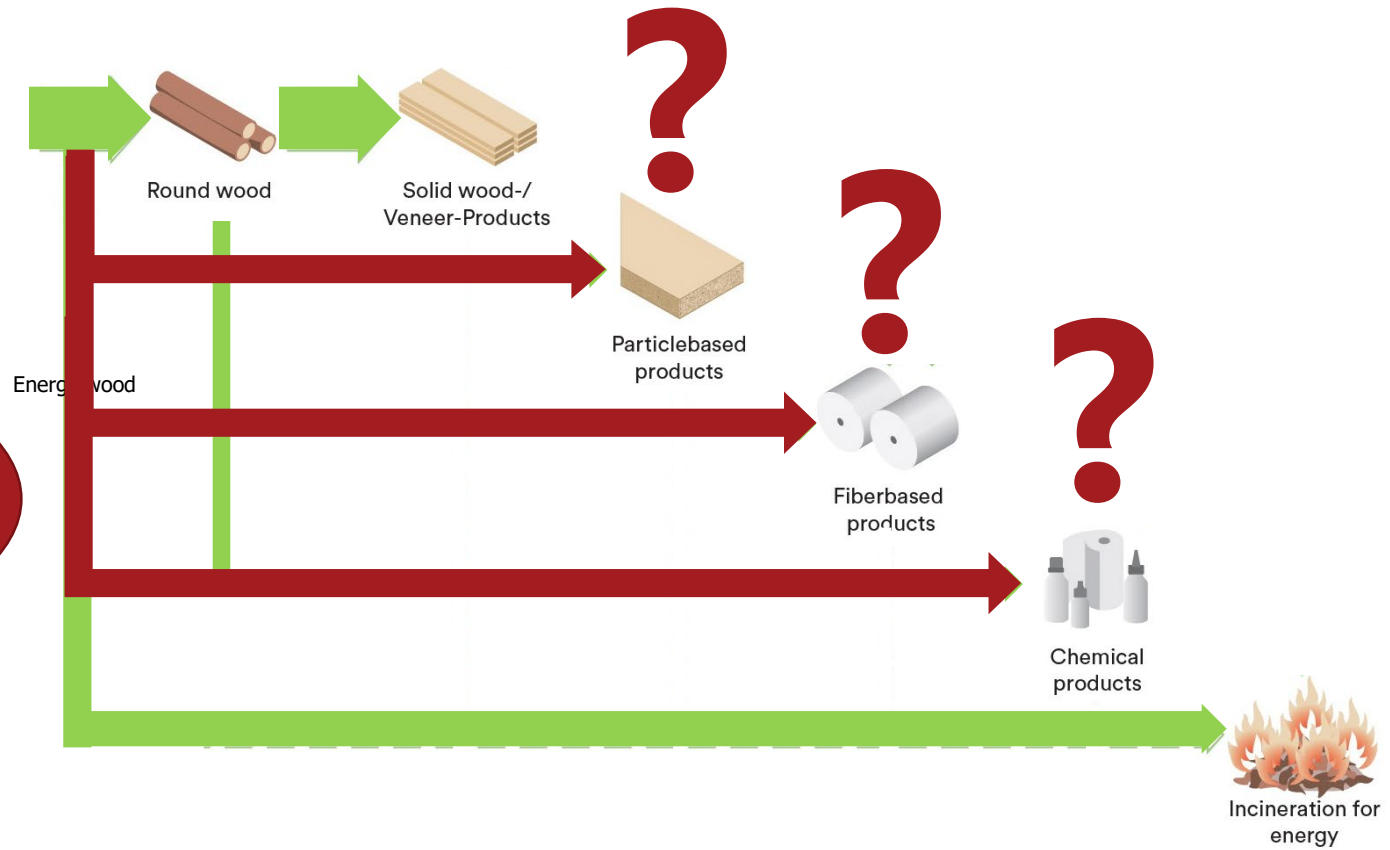
Could we make better use of woody biomass?



Solution 1: More biomass for wood products and less for energy



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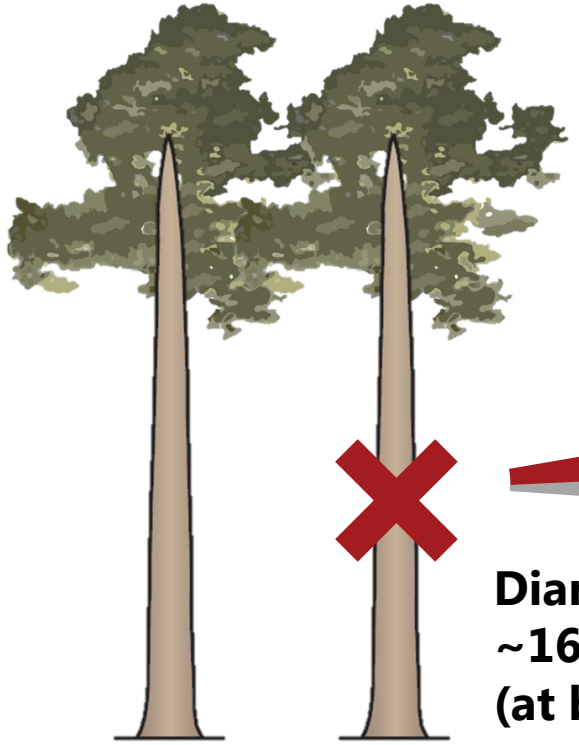
Could we transfer woody biomass from late thinnings?



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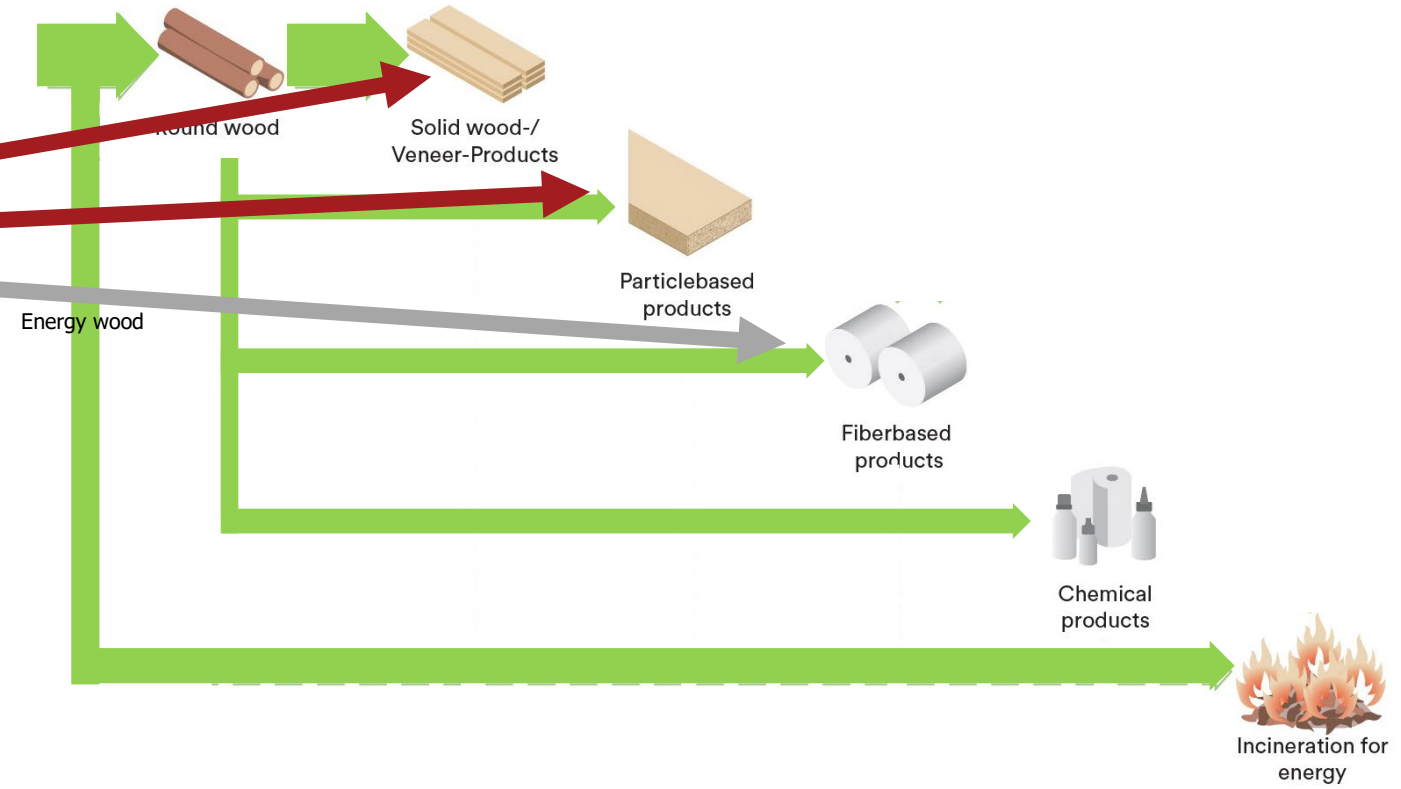
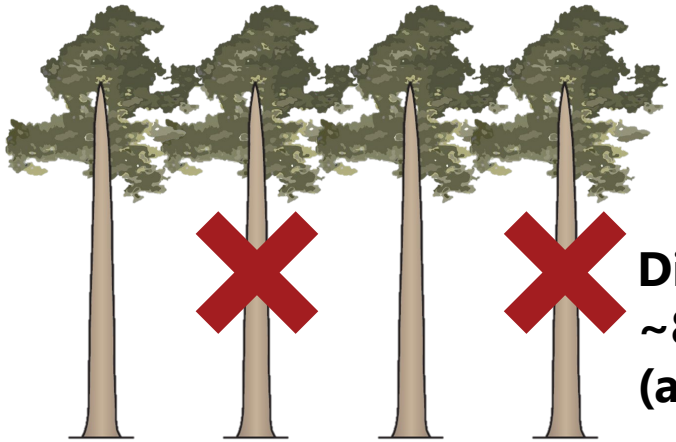
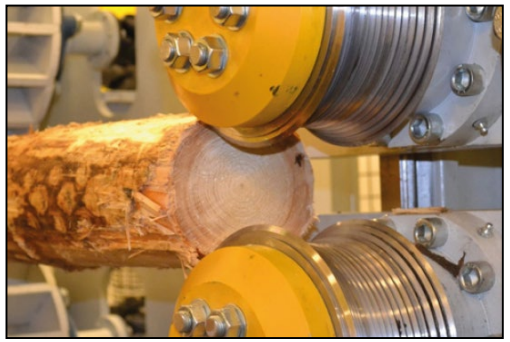


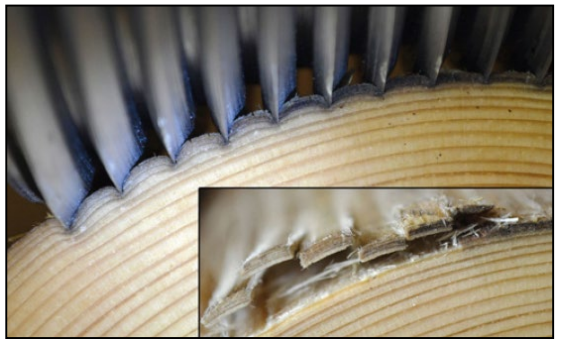


Diameter
~8-9 cm
(at breast height)

Could we transfer woody biomass from late thinnings?

- Could we **split smaller logs into bigger pieces?**
  - *Example:* Macro-fibre technology peels wood logs (>10 cm, pilot scale) to long fibre lamellas



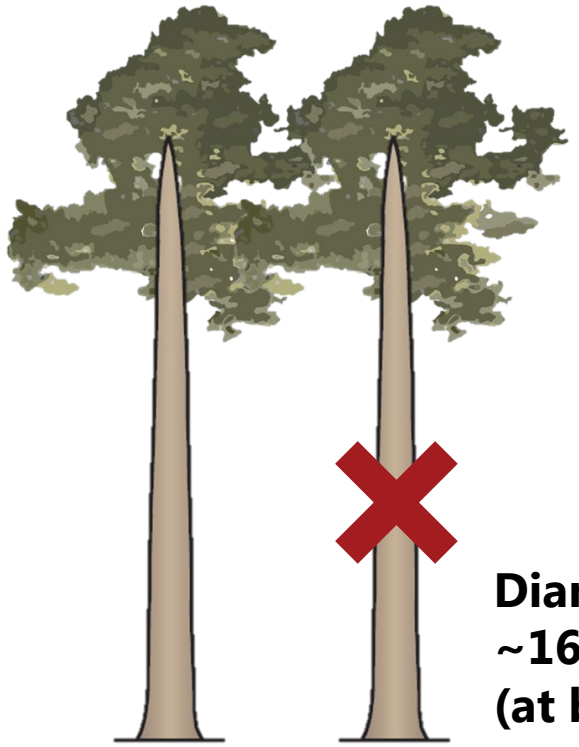


- Could we **assemble smaller pieces into bigger elements?**
  - *Example:* Shorter, straight pieces (1-1½ m) of beech are made into to glulam elements

Frybort et al. (2020) https://doi.org/10.1080/17480272.2020.1778078
Bliem et al. (2020) Holztechnologie, 61(3):30-38

Photo: SRF, 10VOR10, Friday, Oct. 2, 2020 at 22:39

Could we transfer woody biomass from early thinnings?



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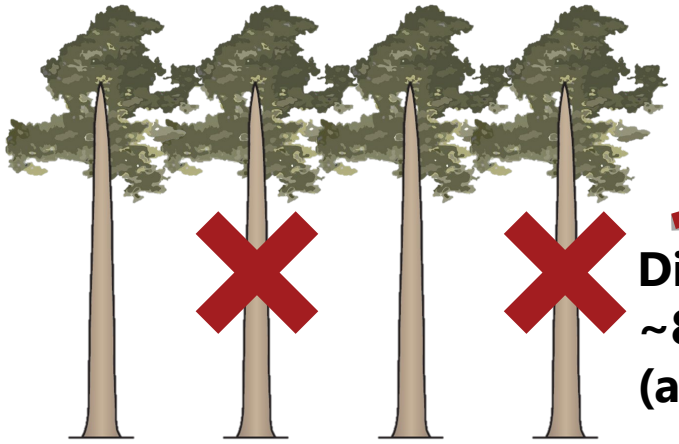

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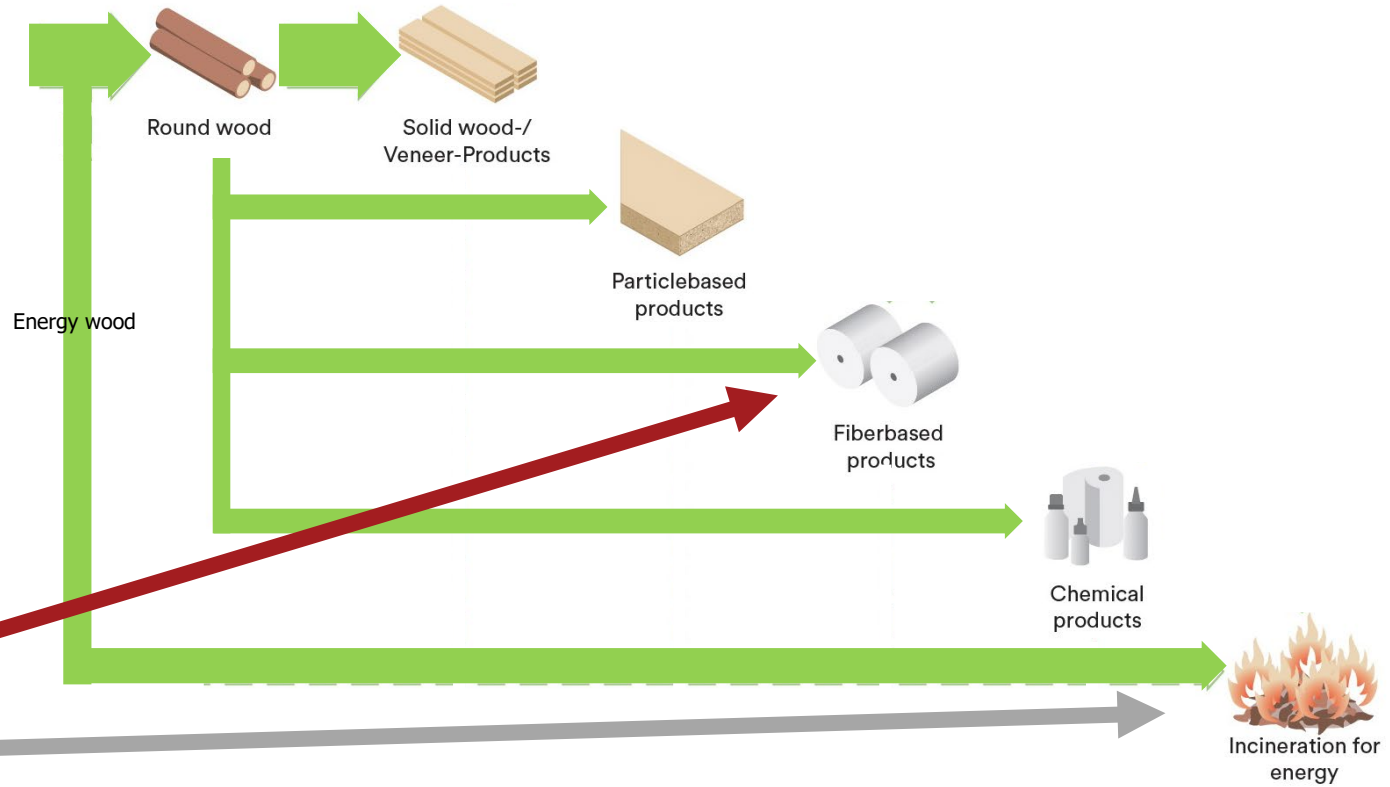


Could we transfer woody biomass from early thinnings?

- Could we **make fibre materials** of the biomass – and what about bark and other impurities?
  - *Example:* Insulation materials or composite materials (+particleboard production is always an option)

+

?

- Could we **make biochar** into useful products?
  - *Example:* Biochar as component in bio composites (e.g. HempCrete)

Kain et al. (2018) https://doi.org/10.1016/j.conbuildmat.2017.12.212

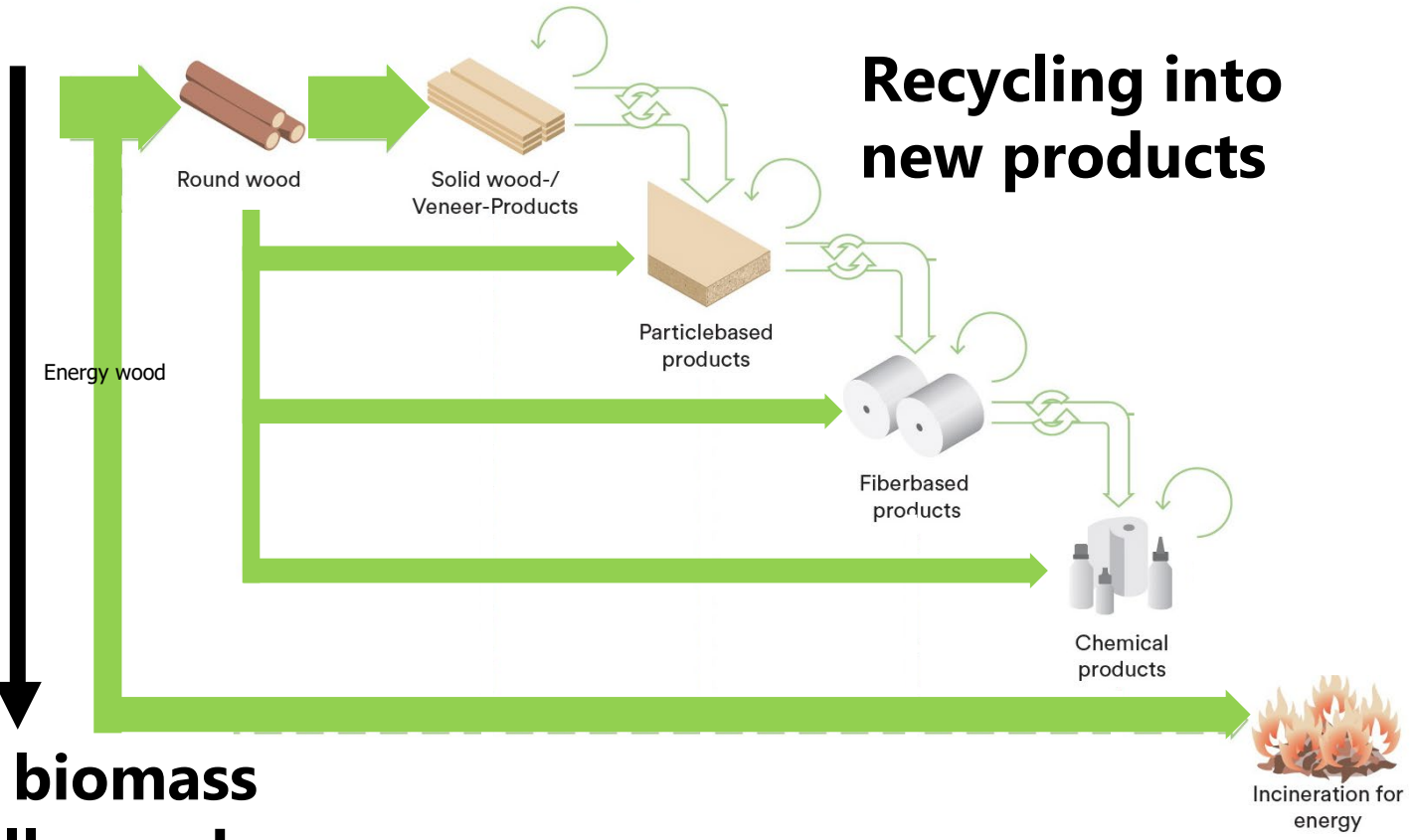
Photos: Oregon Department of Forestry / Wikipedia.org

Could we make better use of woody biomass?

Solution 2: Longer life span of wood in products and less wood waste for energy

Reuse in products of the same type

Recycling into new products



Woody biomass in smaller and smaller pieces

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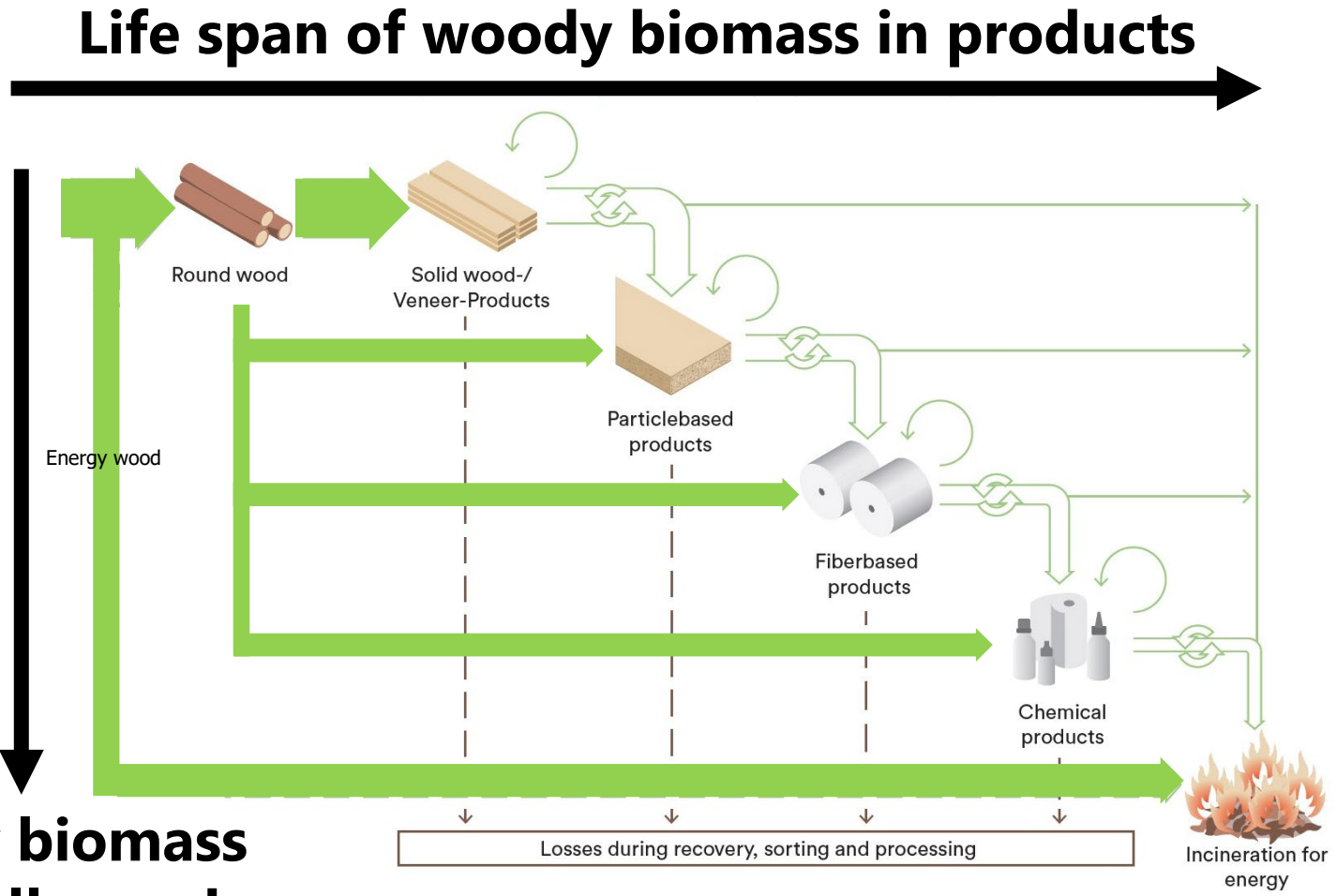

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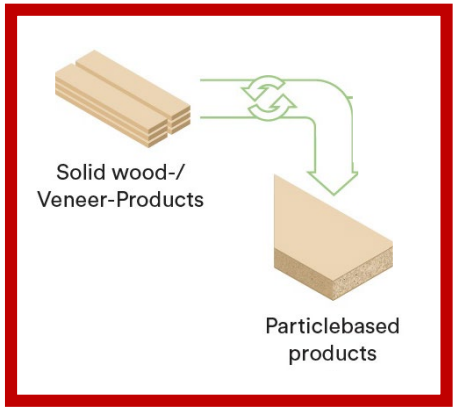
Cascading of reclaimed wood in Denmark



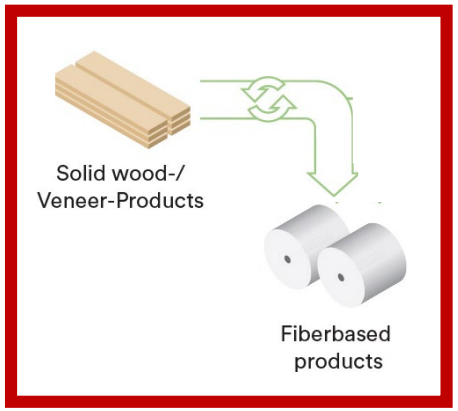
- Reclaimed wood at recycling stations **~400.000 tons/year**
- Half of the wood used for energy is suitable for recycling

Energy by incineration ~50 %

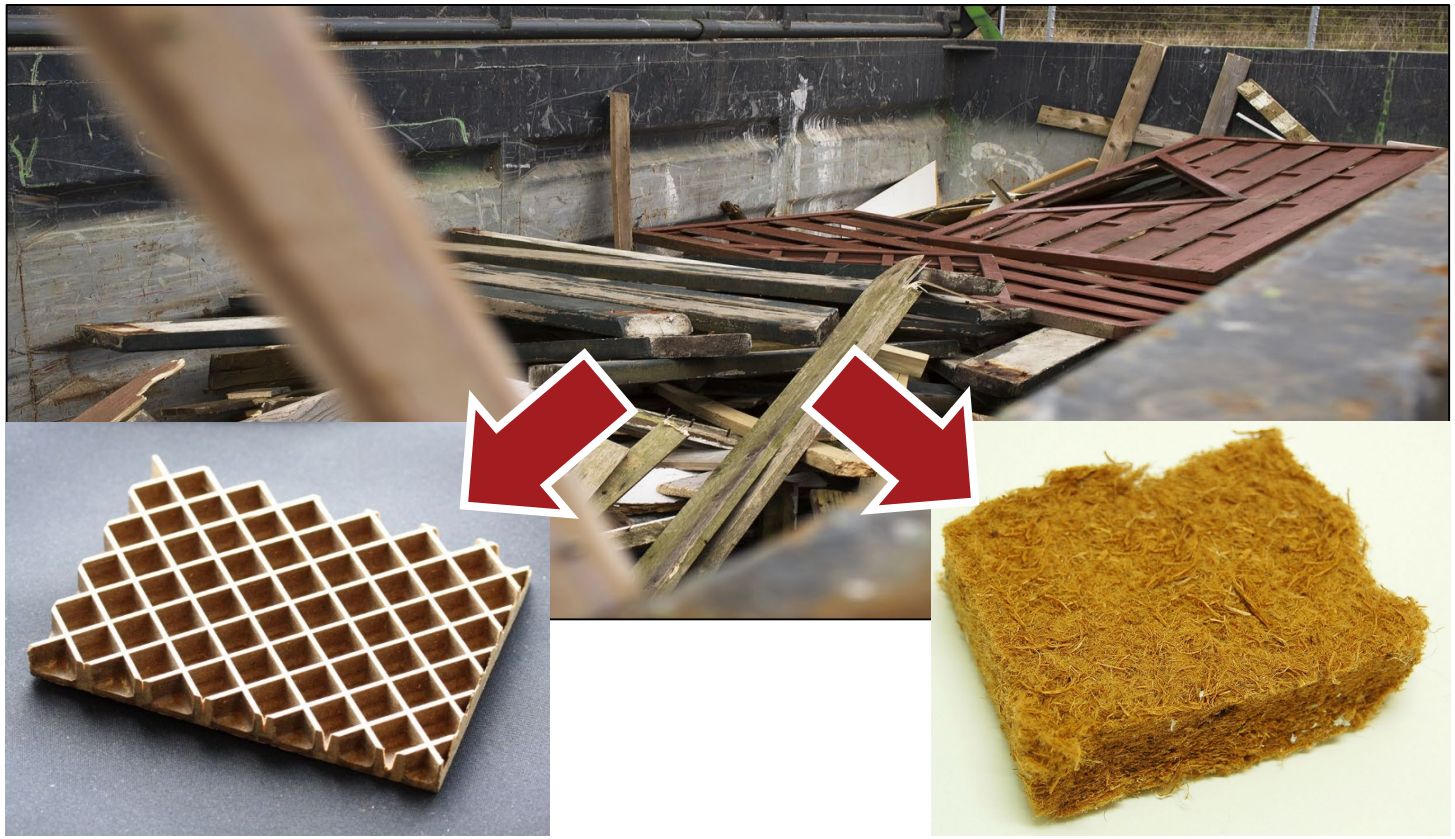
Particleboard ~50%

Miljøstyrelsen (2018) Kortlægning af genanvendeligt træaffald i Danmark
https://mst.dk/service/publikationer/publikationsarkiv/2018/apr/genanvendeligt-traeaffald/

Reclaimed wood for new fibre-based materials?



- Wood split into fibres is an amazing resource for **composite materials** and other fibre-based materials

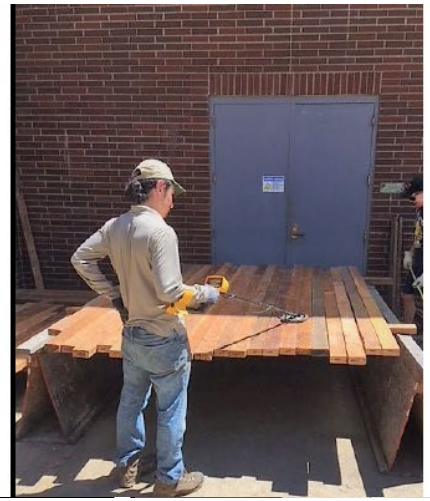


Photos: RenoSyd / thingermejig/ Wikipedia.org

Reuse before recycling?

- Reclaimed wood can be **modified** (e.g. heat treated) to improve the durability in outdoor environments

- Can **structural wood** from demolitions be reused for new structural materials (e.g. glulam, CLT)?

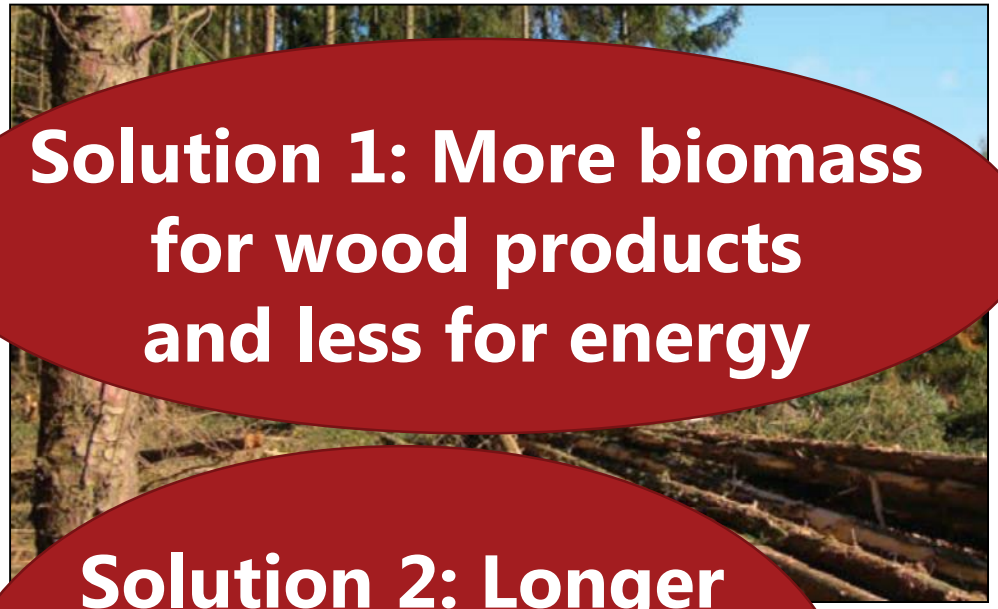

InFutURe Wood

www.infuturewood.info/

Arbelaez et al. (2020) Wood and Fiber Science, 52(2):178-190

ULTRA BRIEF SUMMARY

Could we make better use of woody biomass?



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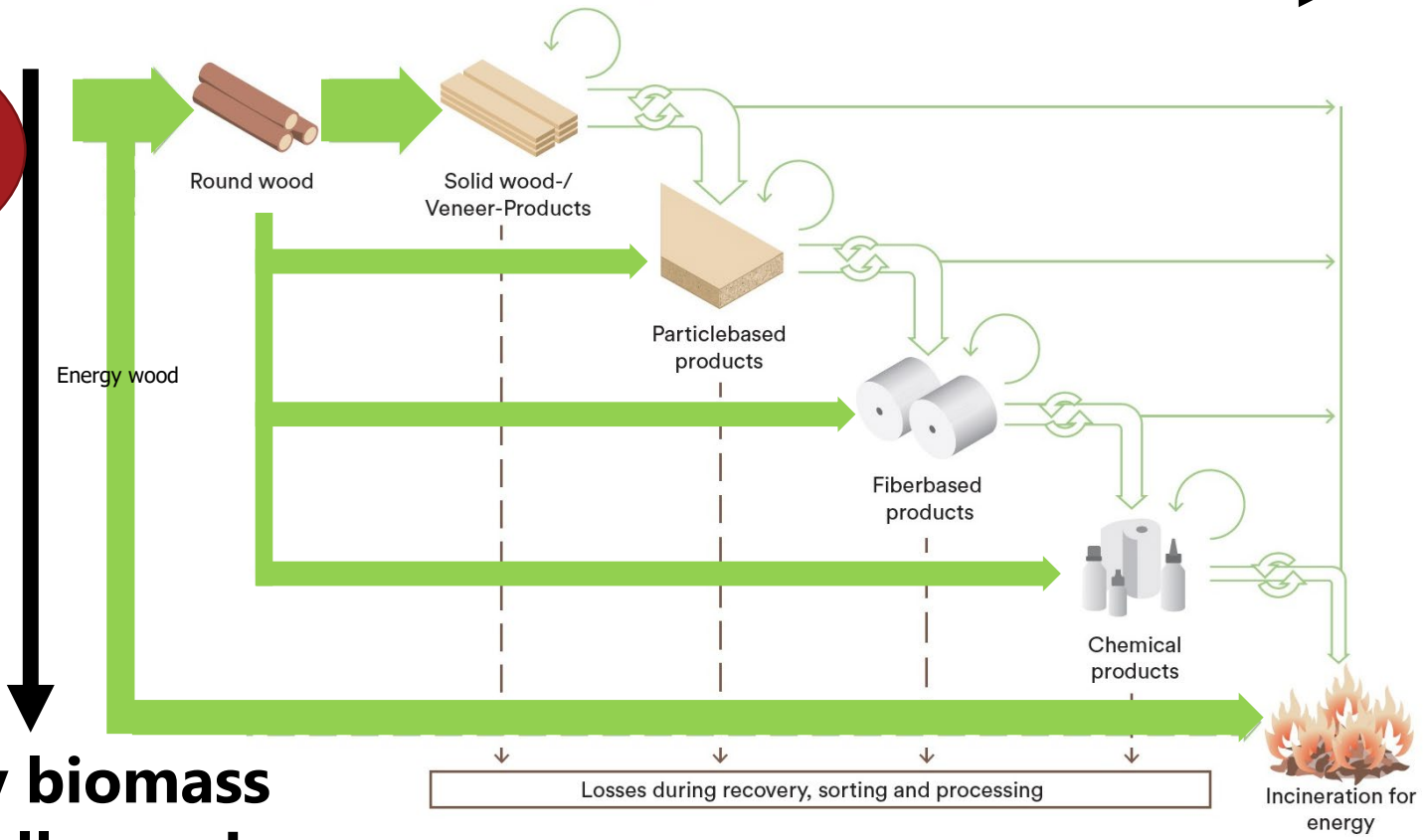
Life span of woody biomass in products



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Could we make better use of woody biomass?

Main message

- we don't loose the possibility of getting energy from woody biomass when using it for materials ..but we gain more value

Aim

- reuse before recycling & recycling before energy

Pre-requisite

- a wider range of material technologies and product types

Questions?

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Photo: Lisbeth Holten