Life cycle assessment of different energy production scenarios in a paper and pulp mill

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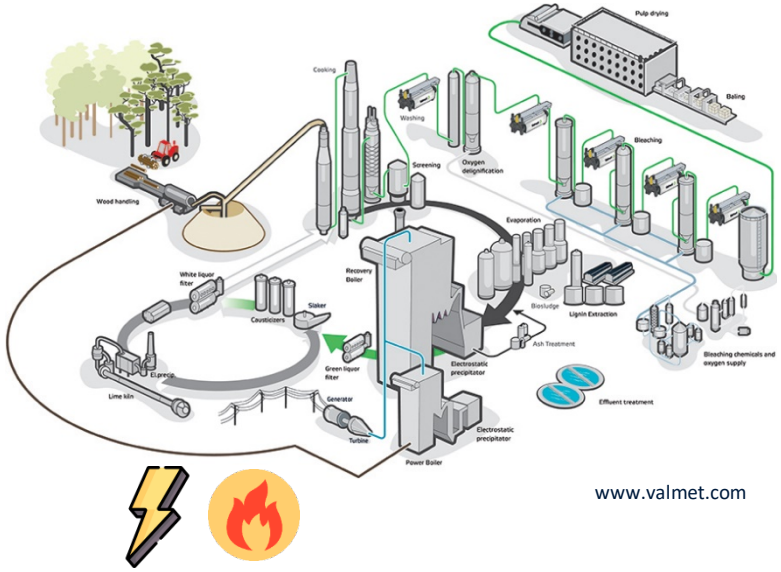
Challenges of the Paper and Pulp Industry



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High energy intensity

Rely on fossil resources

Waste/secondary raw materials

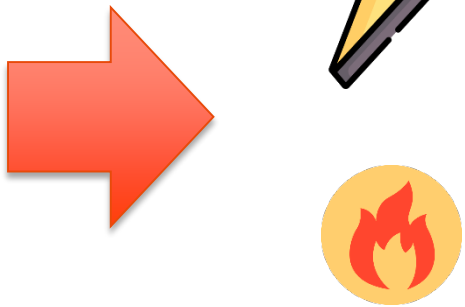
Aim of this research

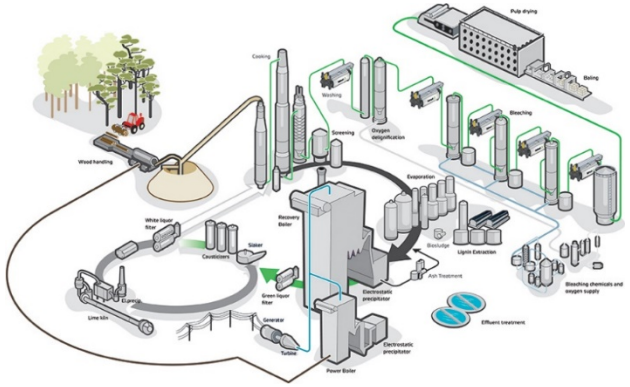
Natural Gas

Coal

Forest Residues (branches, tree tops)

Sugarcane bagasse





Heat and electricity requirements of a pulp & paper mill located in South Africa

- What are the **environmental advantages/limitations** of different energy production scenarios in the P&P industry compared to the benchmark process?

Life cycle assessment (LCA) framework

Goal And Scope

- To **'prospectively' assess** the environmental performance of different **energy production scenarios** in a P&P mill located in South Africa.
- To **support stakeholders** in the decision-making about alternatives for energy production in the P&P mill.

Scope → Cradle to gate (Extraction of wood until pulp production)

Functional unit: 1 kilogram of unbleached pulp (soft and hardwood) at the factory gate in a P&P mill located in South Africa.

Life Cycle Inventory

- Data collected from P&P mill in South Africa.
- **Background data** → Ecoinvent V3.7

Allocation method

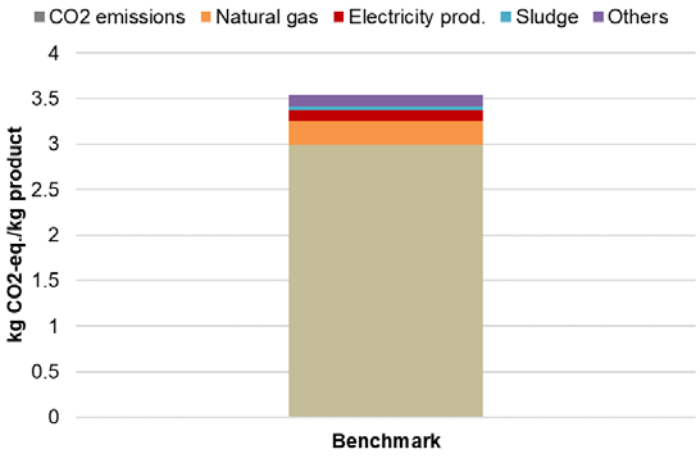
- **Economic allocation** → Forestry products

Impact Assessment

- Global Warming Potential (GWP)
- Fossil depletion potential (FDP)
- Agricultural land occupation (ALOP)
- Water depletion potential (WDP)

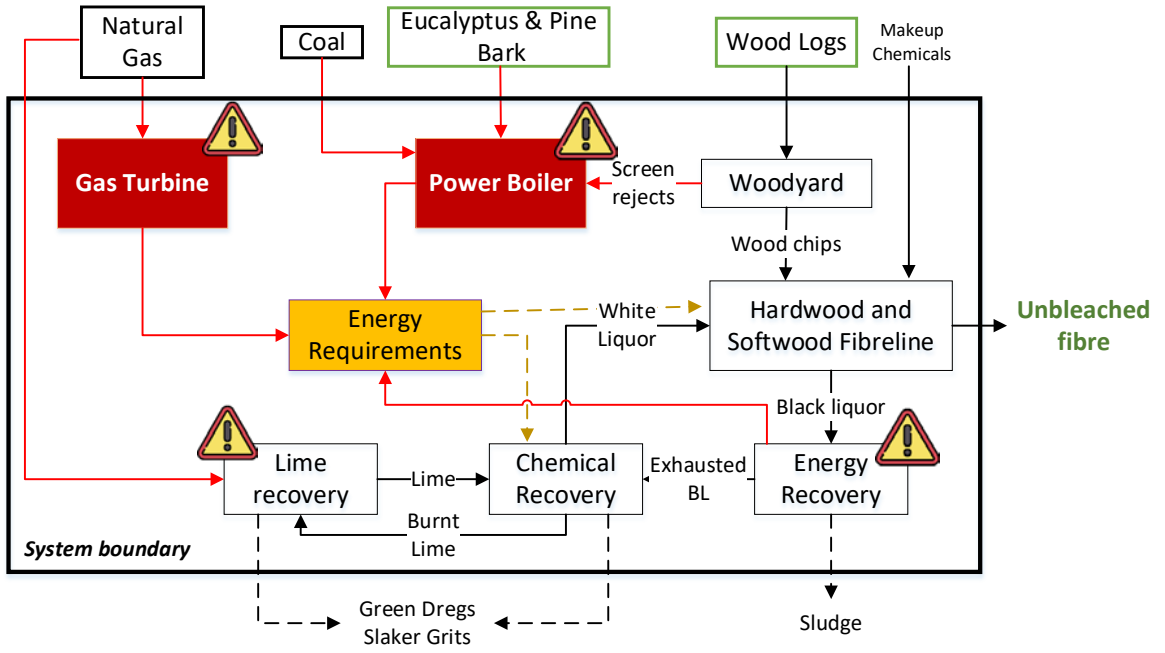
Environmental impacts of benchmark scenario

Global Warming Potential



Agricultural Land Occupation Potential

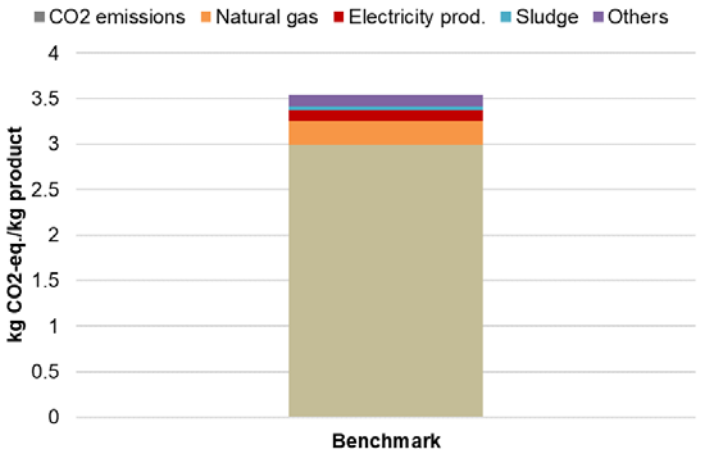
Fossil depletion Potential



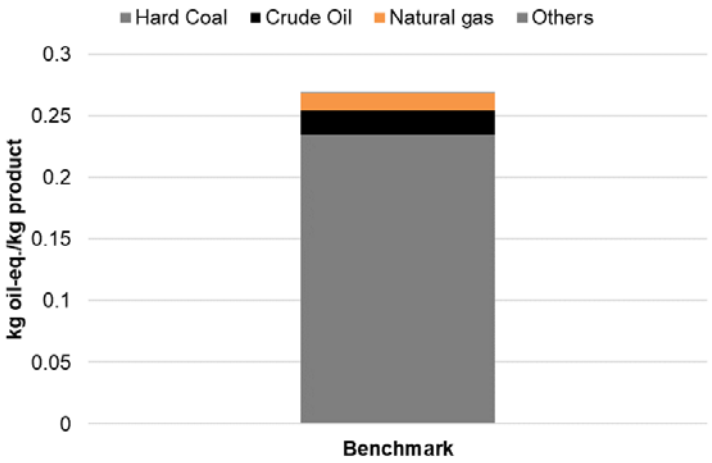
Water Depletion Potential

Environmental impacts of benchmark scenario

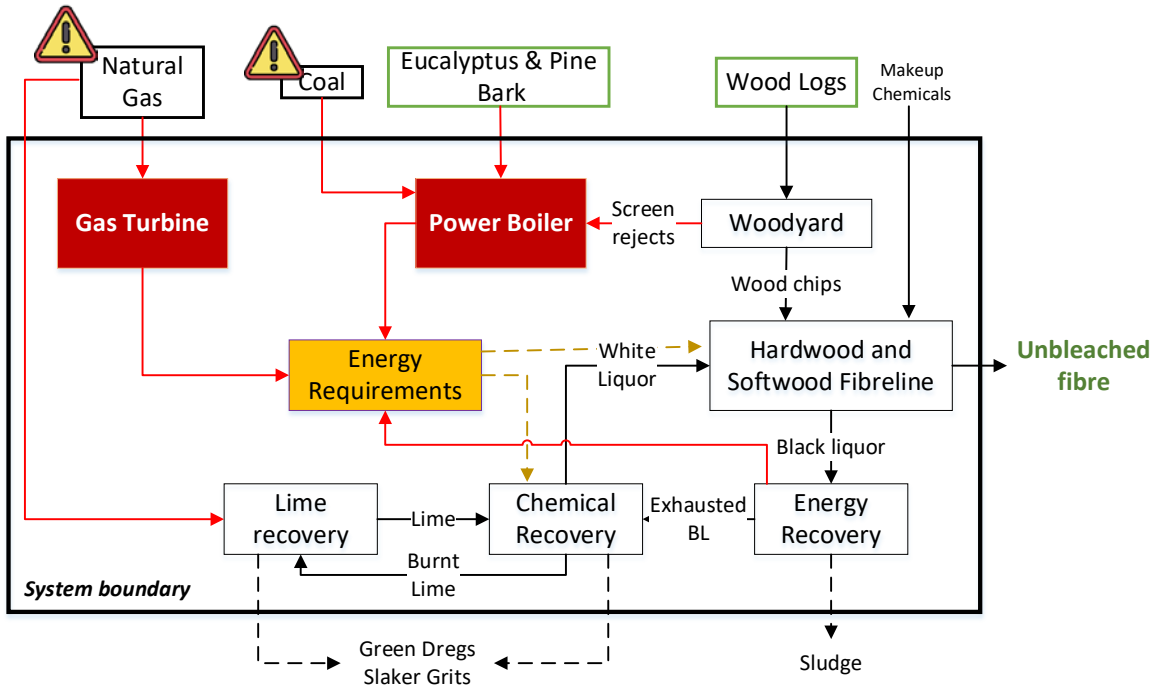
Global Warming Potential



Fossil depletion Potential



Agricultural Land Occupation Potential



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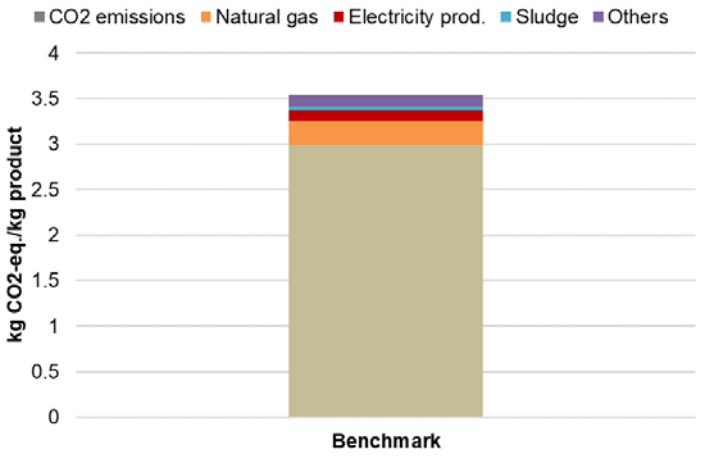

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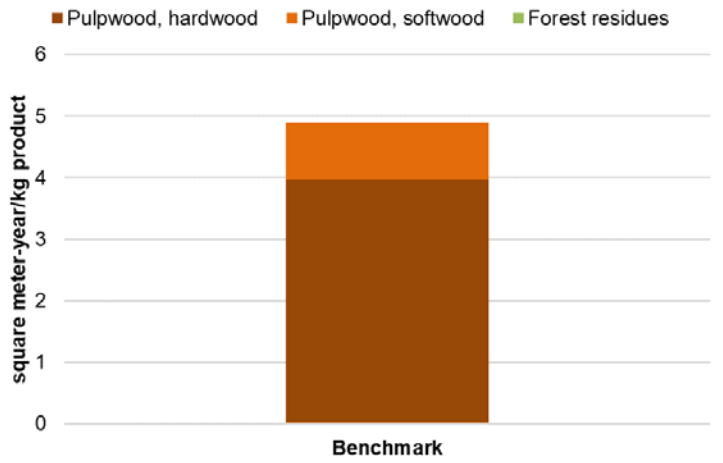
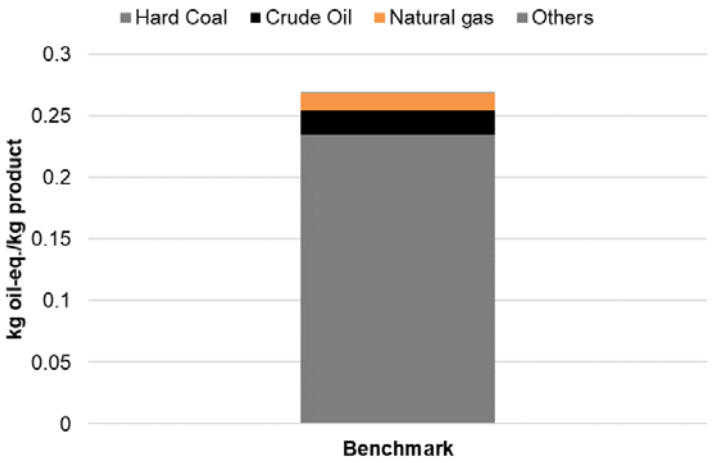
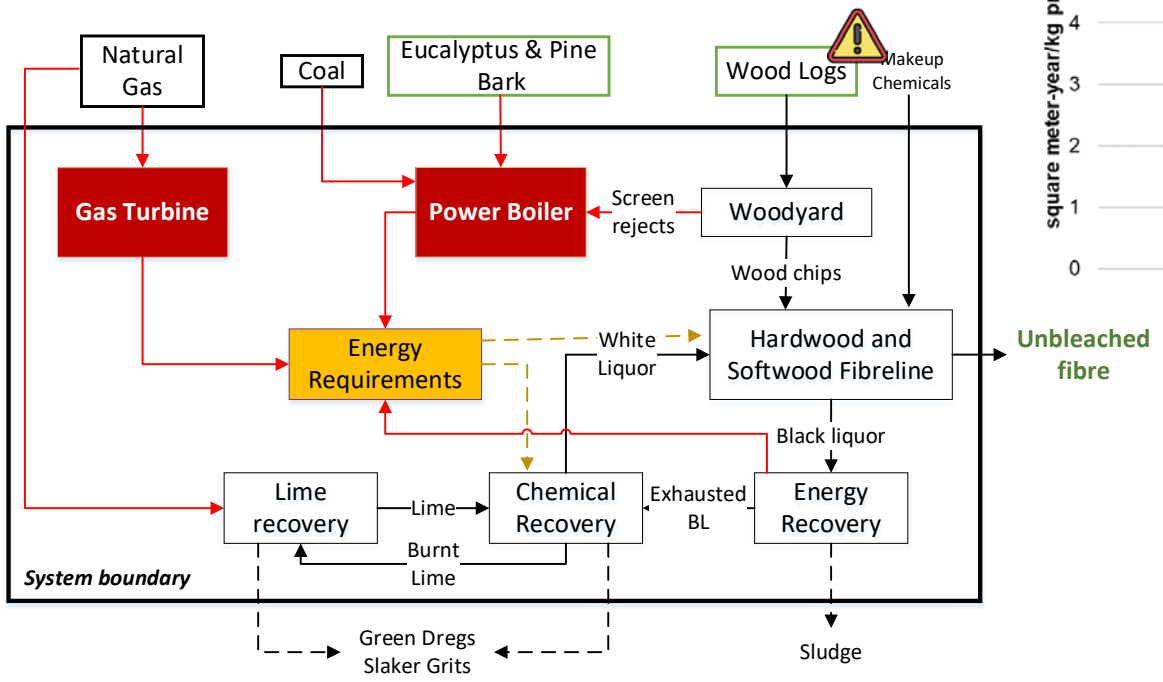


Fossil depletion Potential





Water Depletion Potential

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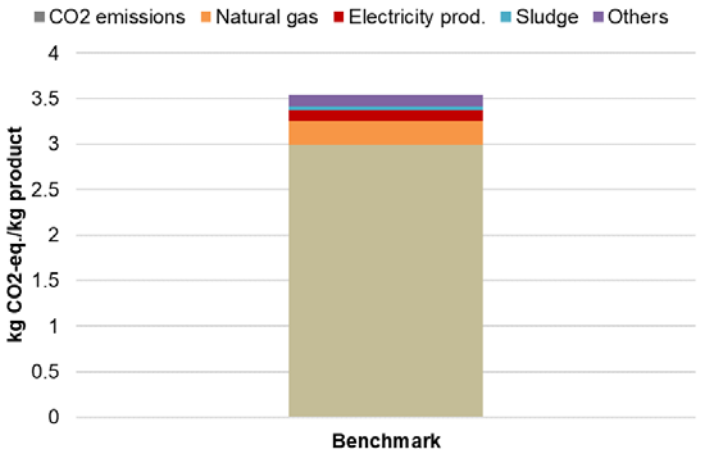

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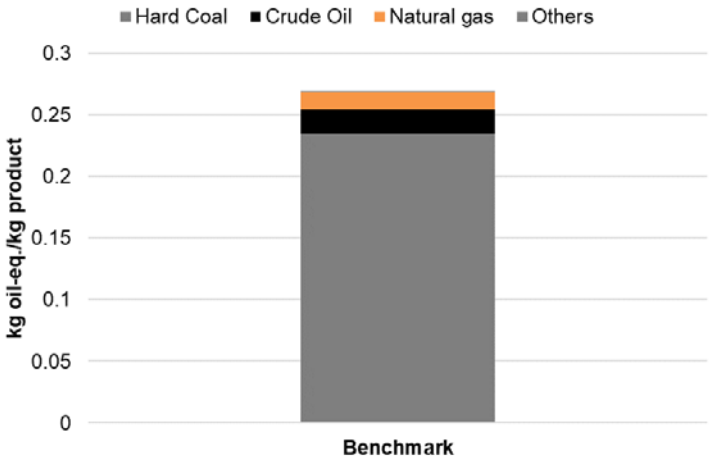
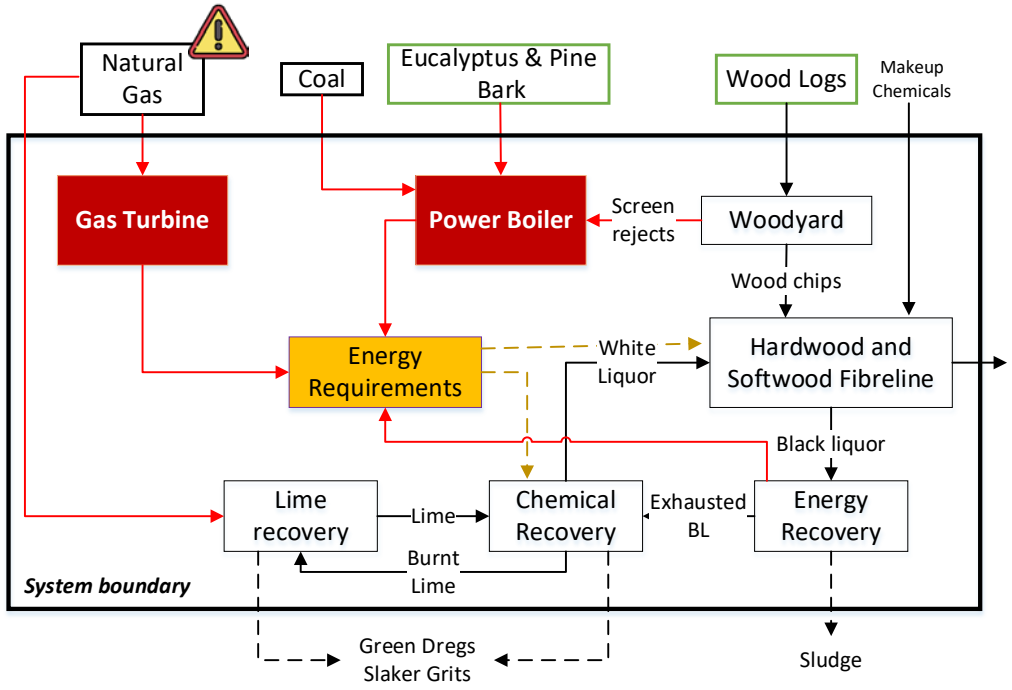
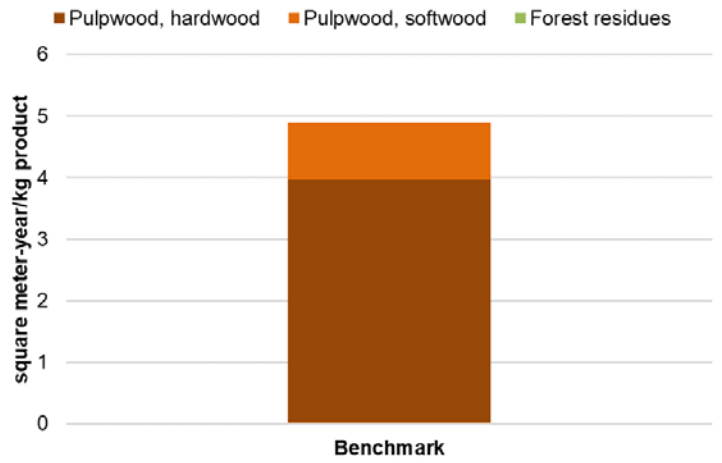
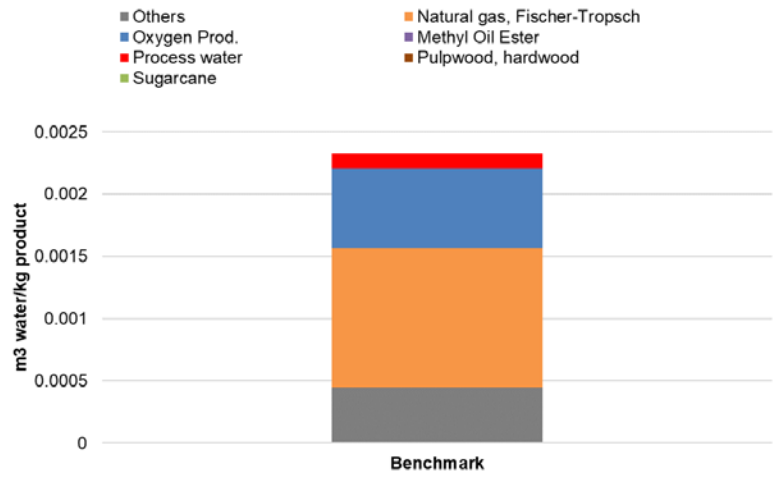




Agricultural Land Occupation Potential

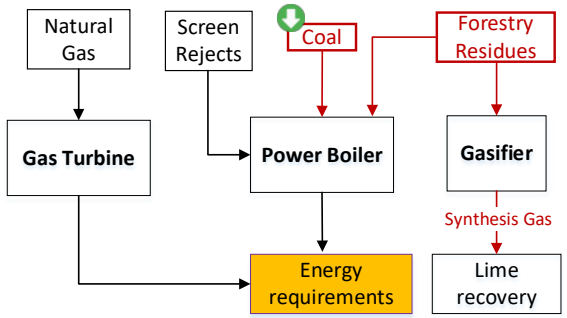


Water Depletion Potential



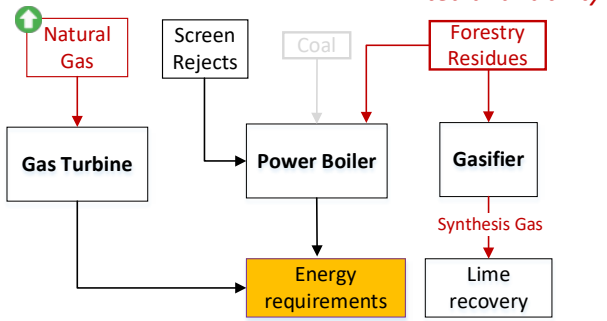
Scenario Analysis

Scenario 1

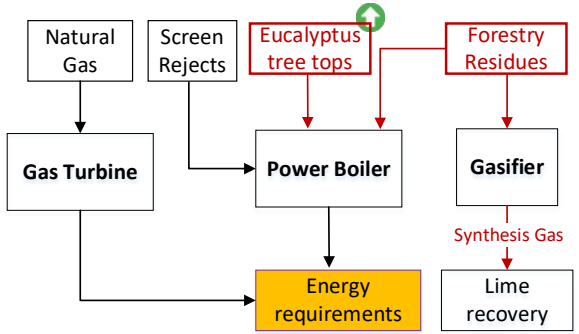


Scenario 2

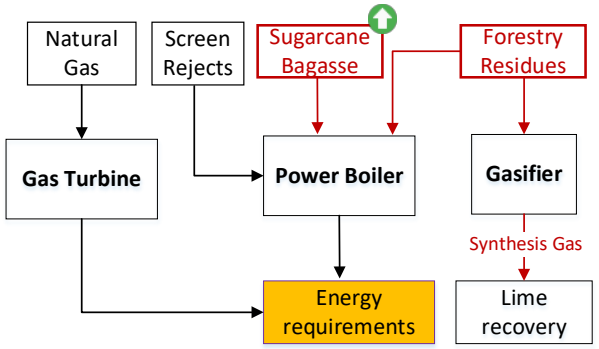
Limited availability

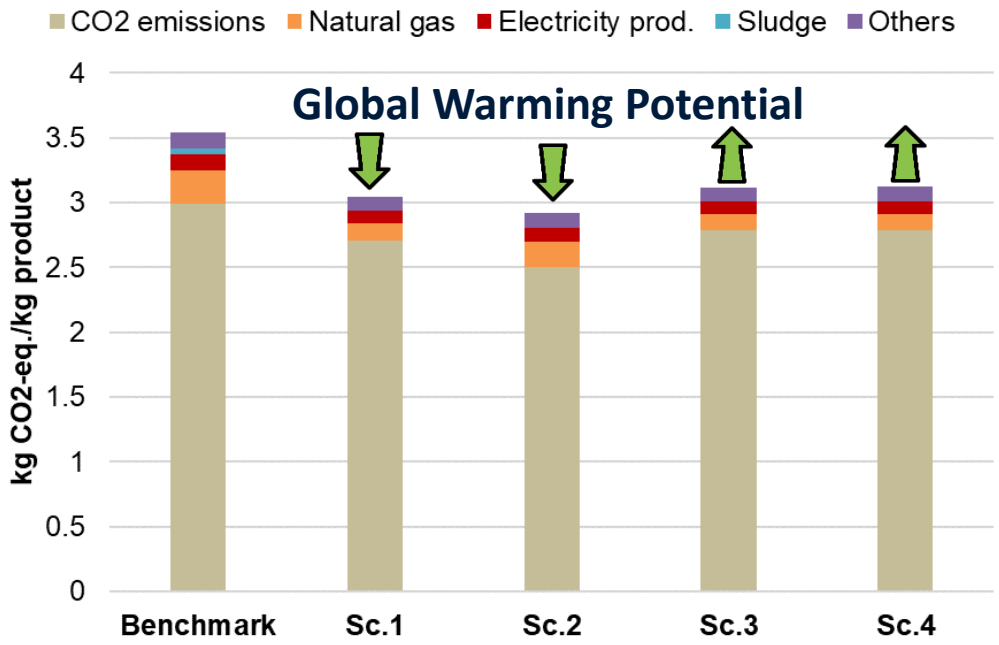


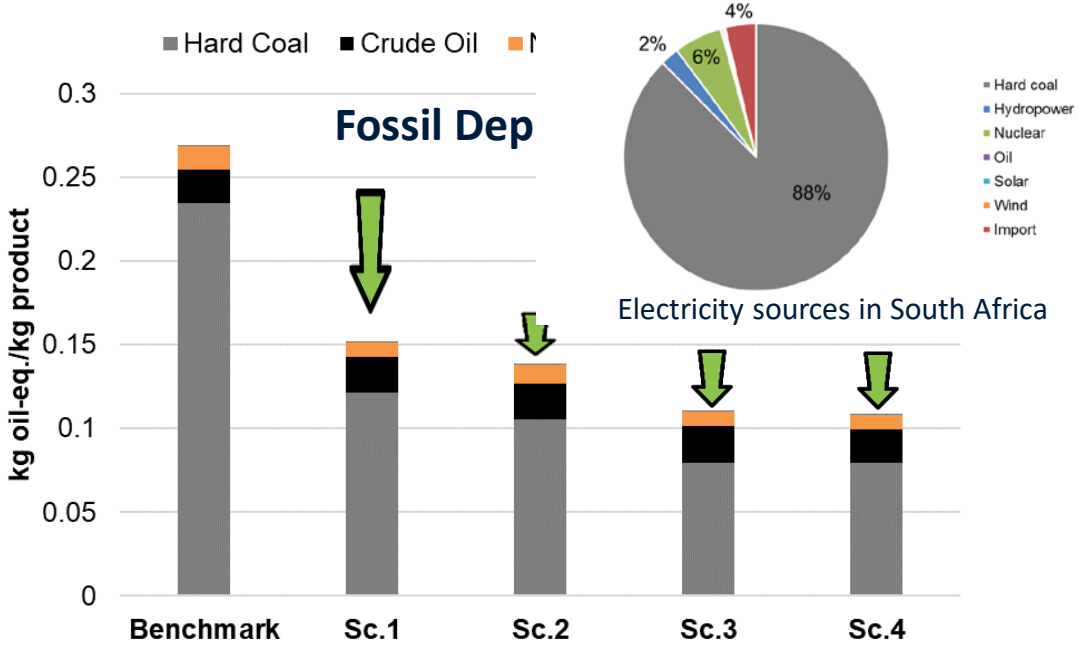
Scenario 3



Scenario 4



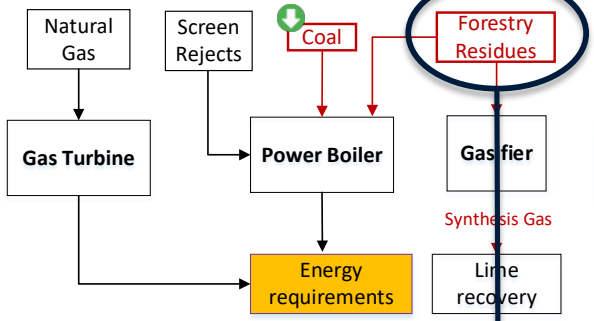




**No biogenic carbon was included in the modeling*

Scenario Analysis

Scenario 1



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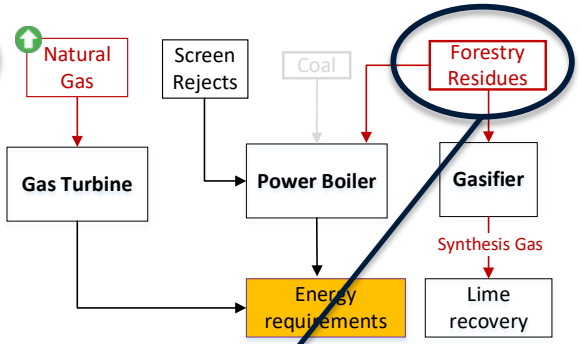

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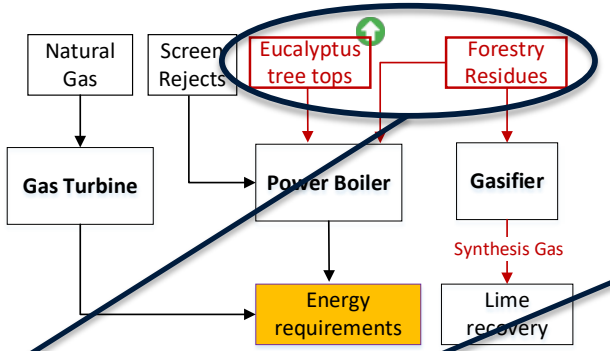

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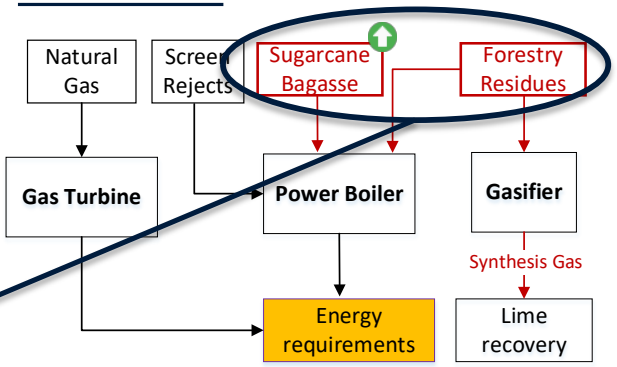

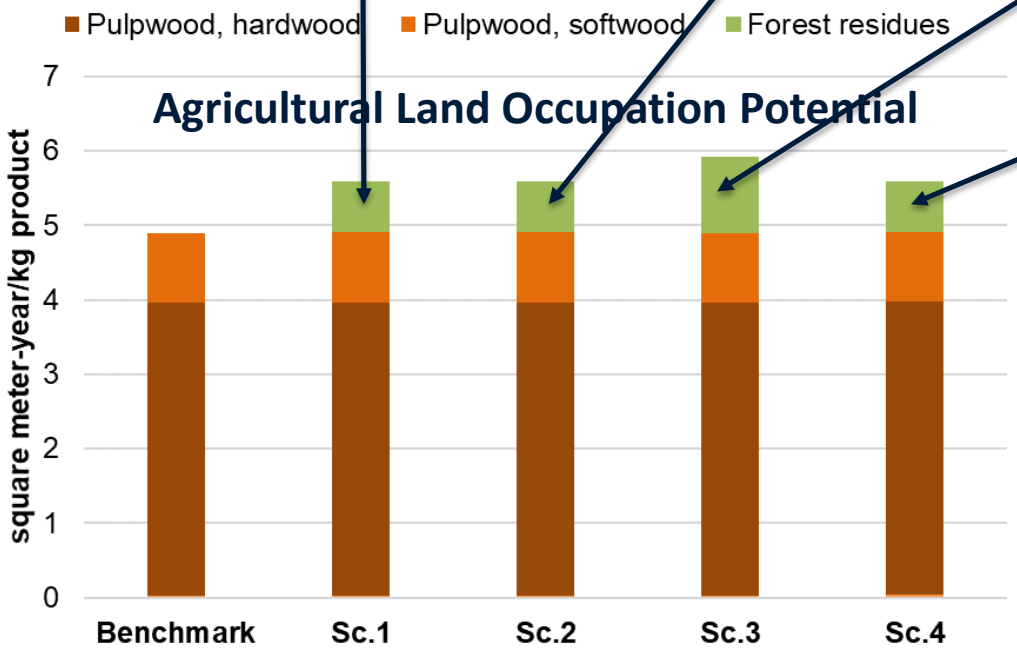

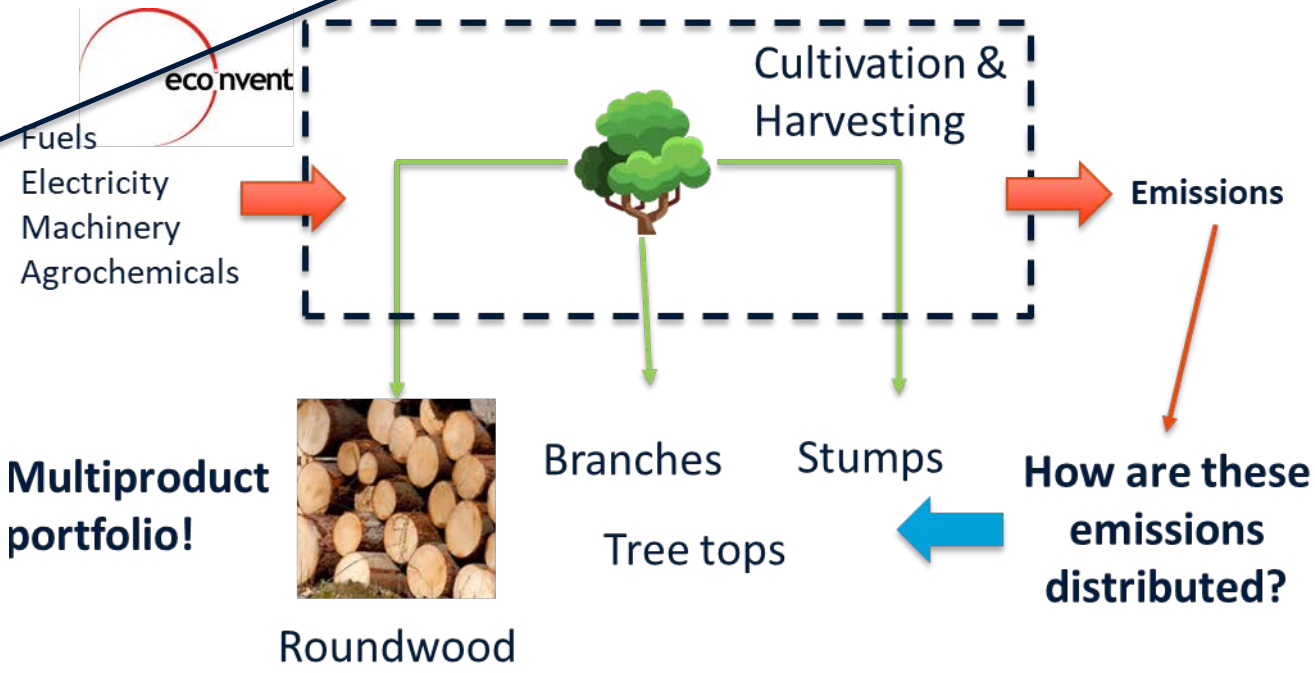

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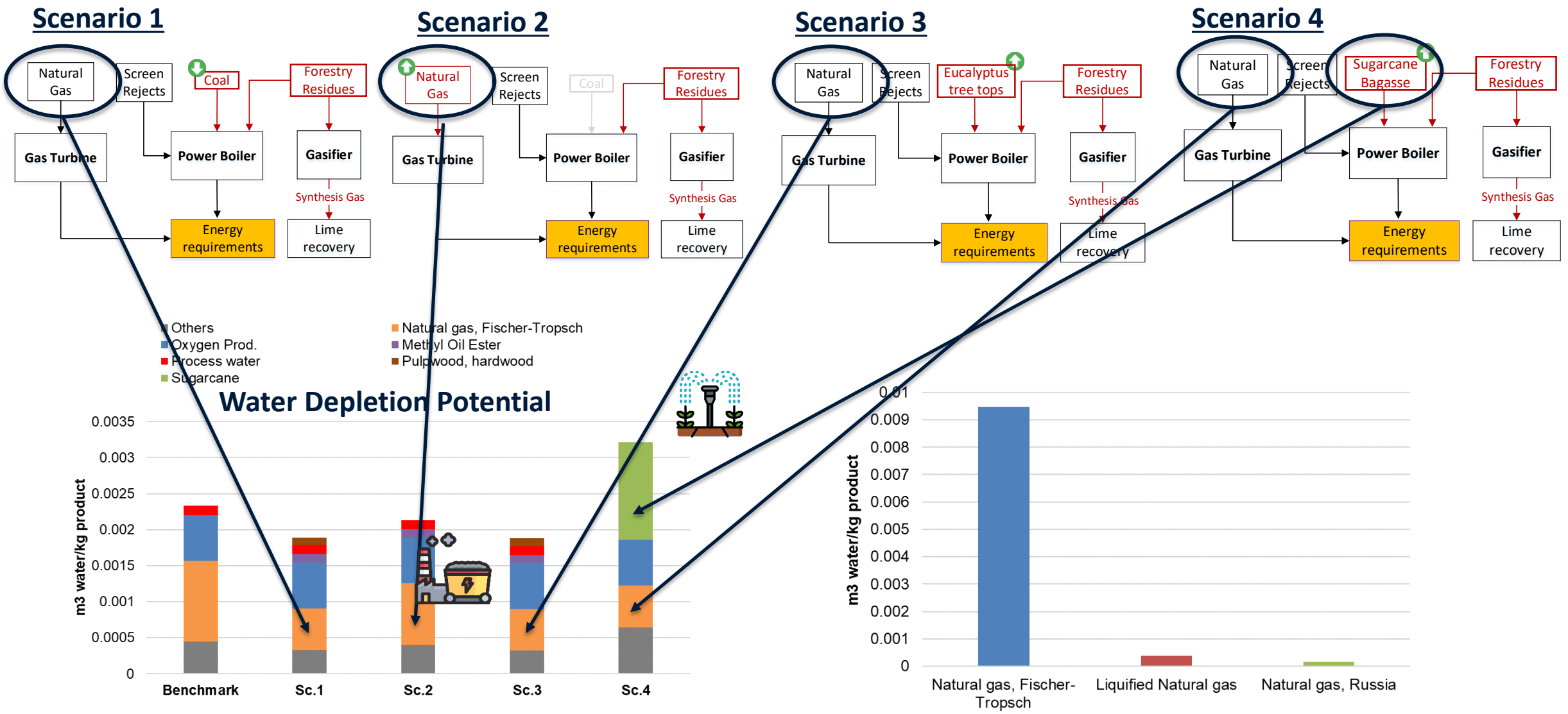

Conclusions

- **Forest residues (tree branches and top trees) and sugarcane bagasse** are good alternatives for energy production in P&P mill → Mitigate negative impacts (most impact categories).

- Impacts on **land use** → Methodological choices (allocation approaches).
- Impacts on **water use** → Other sources of natural gas and crop irrigation.

- **Natural Gas Prod.** in South Africa was the hotspot in most categories → Biomass availability to supply extra energy demand.

Thanks for listening!

Any question/comment you can contact me

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SCAN ME

Get in touch! ☺