

Supplementary Material

Appendix A. Air separation unit

In the air separation unit (ASU), the new AGENT flow, which is injected directly into the combustion zone (COMBUZON), is the result of partial nitrogen removal (NITROGEN) from the original atmospheric airflow (ATMAIR), as shown in Figure S1.

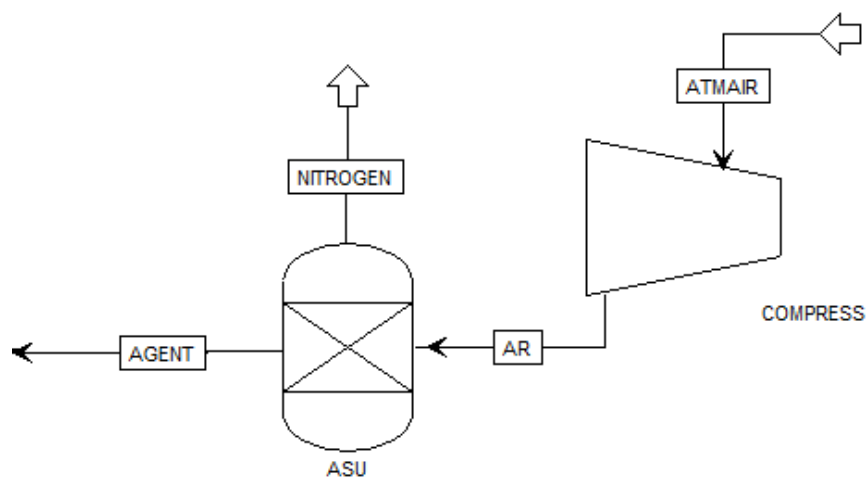


Figure S1. ASU used during downdraft gasifier feeding with oxygen-enriched air.

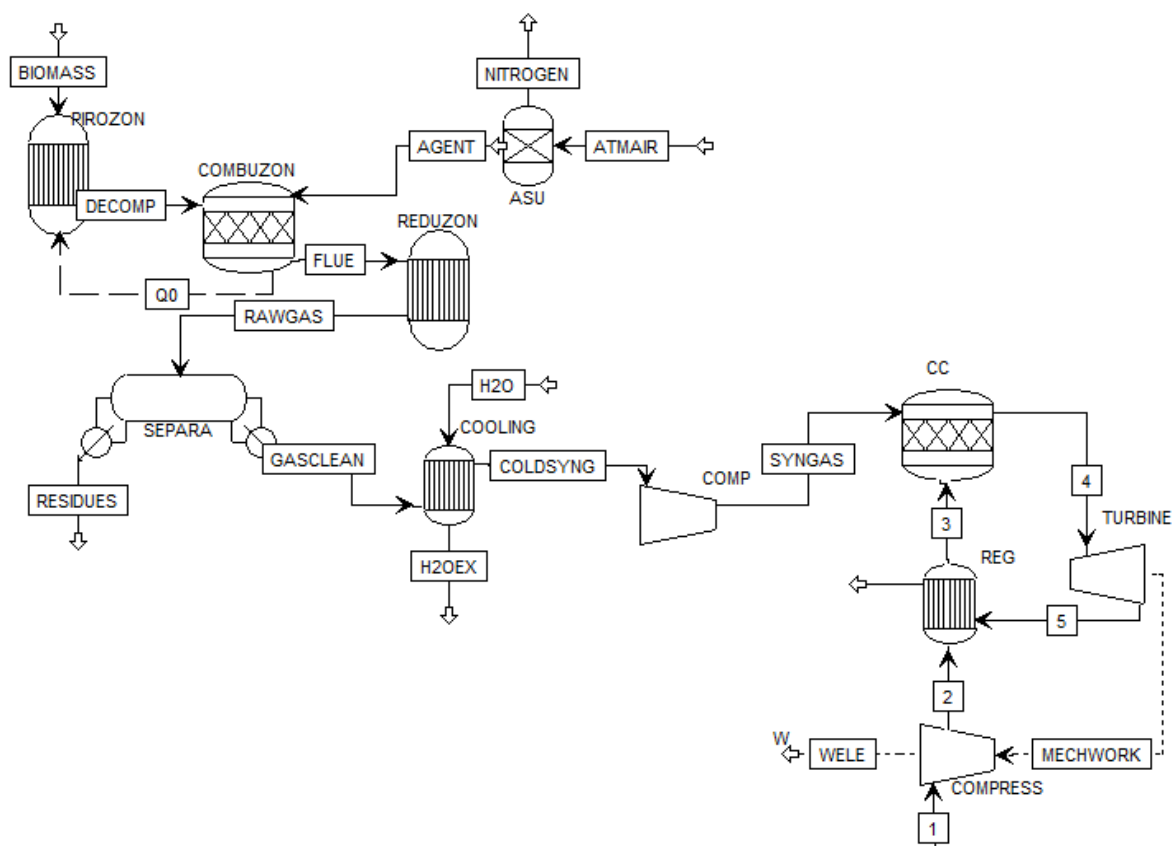


Figure S2. Scheme for oxygen-enriched air gasification scenario.

Appendix B. Syngas Low heating value (LHV) for the oxygen-enriched air gasification scenario

A considerable increase in the syngas LHV has been observed as the oxygen concentration in the enriched air is favored, as presented in Figure S3. This figure also indicates the effect of gasification temperature on syngas LHV.

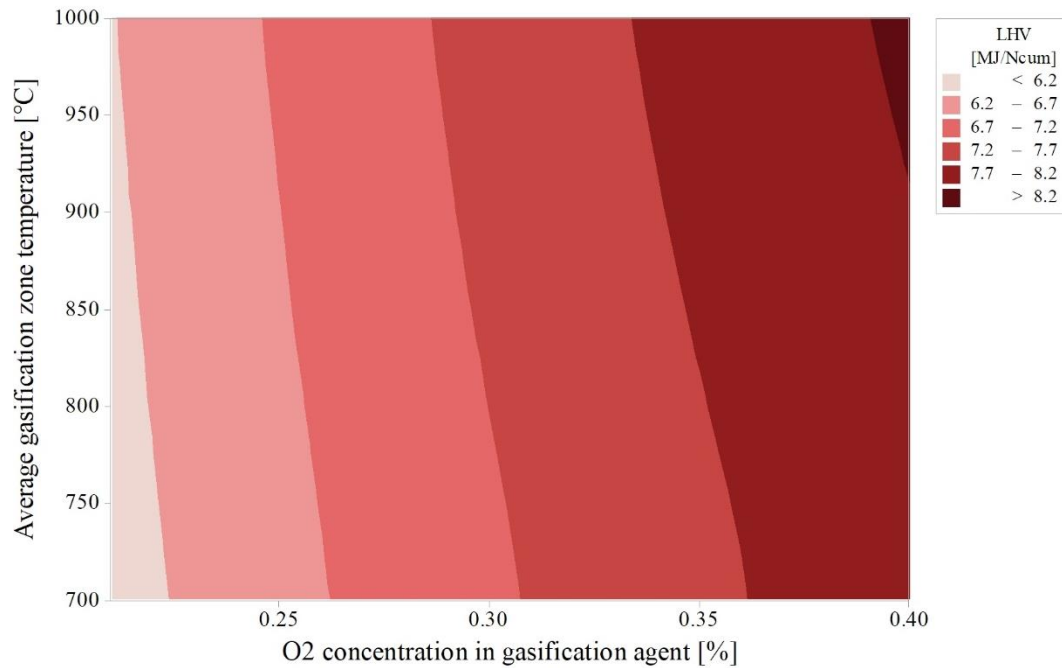


Figure S3. Syngas LHV as a function of both oxygen concentration in enriched air flow and gasification temperature

As shown in Figure S3, raising the temperature of the reduction region also promotes the LHV increase, but to a lesser extent. The LHV of the syngas produced can reach 8.27 MJ/Nm³ when the gasification temperature is around 1,000 °C and the oxygen concentration in the enriched airflow is 40%. In the baseline case (ER = 0.30; O₂ = 40%; T = 850 °C) the LHV obtained was 8.14 MJ/Nm³.

Appendix C. Benefit/Cost ratio

The benefit/cost ratio of the project is presented in Figure S4. The results show that the benefit/cost ratio does not exceed the value of 1; therefore, the project is not financially viable.

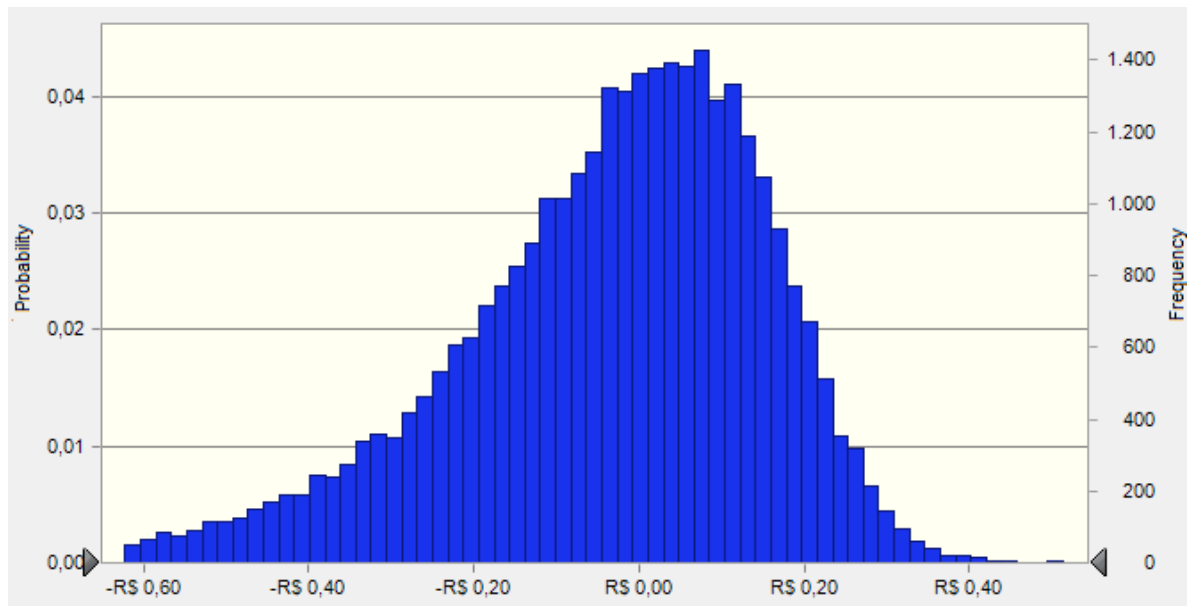


Figure S4. Benefit/Cost ratio