

Supplementary material - Tables with estimates for CapEx and OpEx of gasification technologies

Determining the best approach for biomass gasification can be challenging due to the many factors that must be considered, including cost, performance, syngas composition, and final application. The following is a series of tables highlighting the trade-offs between different options, allowing users to identify the most suitable combinations for their needs and circumstances. While these tables can provide estimates for CapEx and OpEx for a hypothetical gasification plant, it is important to note that actual costs will depend on a wide range of factors, including the specific design and location of the system, the type and quality of feedstock used, and prevailing economic conditions.

Table S1. Estimates for CapEx and OpEx according to gasifier type.

Gasifier type	CapEx	OpEx	Reference
Fixed-bed	1000€ - 4000€ per kW	0.01€ - 0.16€ per kWh	[40,77,78]
Fluidized-bed	2500€- 5000€ per kW	0.09€- 0.15€ per kWh	[79]
Entrained-flow	2000€ - 6500€ per kW	0.02€ - 0.05€ per kWh	[80]
Plasma	5000€ - 10,000€ per kW	0.05€ - 0.20€ per kWh	[3,81,82]
Circulating fluidized bed	1500€- 6500€ per kW	0.08€- 0.12€ per kWh	[83]
Dual fluidized bed	2500€- 8000€ per kW	€0.05€ - 0.08€ per kWh	[84,85]

Table S2. Estimates for CapEx and OpEx according to oxidizing agents.

Oxidizing agent	CapEx	OpEx	Reference
Air	800€ – 4500€ per kW	0.05€ - €0.12€ per kWh	[14,77]
Steam	1500€ - €4500€ per kW	0.07€ - €0.13€ per kWh	[23,77]
O ₂	2500€ - €6500€ per kW	0.10€ - €0.17€ per kWh	[11,77,86]
CO ₂	2500€ - €6000€ per kW	0.09€ - €0.15€ per kWh	[17,77]

Table S3. Estimates for CapEx and OpEx according to syngas cleaning and tar cracking technologies.

Technology	CapEx	OpEx	Reference
<i>Syngas cleaning</i>			
Cyclones	1.64 €- 3.78€ per kW	n/a	[87]
Filters	10.04€ - 30.80€ per kW	n/a	[87]
Scrubbers	50€ - 500€ per kW	0.03€ - 0.05€ per kWh	[88-91]
Adsorbents	200€ - 800€ per kW	0.02€ - 0.03€ per kWh	[92]
<i>Tar cracking</i>			
Catalytic	n/a	0.05€ - 0.10€ per Nm ³	[93-95]
Thermal and plasma	n/a	0.02€ - 0.10€ per Nm ³	[3,29,82,96-98]

Table S4. Estimates for CapEx and OpEx according to syngas application.

Application	CapEx	OpEx	Reference
<i>Energy</i>			
Combustion chamber and boiler	1,00€ - 2500€ per kW	0.03€ - 0.05€ per kWh	[99-103]
Combustion steam turbine and generator	500€ - 1500€ per kW	0.05€ - 0.08€ per kWh	[101,104,105]
Combustion in an ICE engine	500€ - 1500€ per kW		[105-110]
Combustion gas turbine	500€- 6000€ per kW	0.05€ - 0.10€ per kWh	[111-116]
CHP heat recovery equipment	100€ - 500€ per kW		[109,116-118]
Fuel cell	2000€ – 12,000€ per kW	0.10€ - 0.50€ per kWh	[116,117,119-122]
Biomass-integrated gasification combined cycle	1300€ – 10,000€ per kW	0.05€ - 0.15€ per kWh	[121,123-125]
<i>Gasification to chemicals</i>			
Hydrogen	3000€ - 7500€ per kW	0.02€ - 0.14€ per kWh	[126-129]
Methane	800€ - 1200€ per kWh	0.03€ - 0.06€ per kWh	[33,34,130-133]
Methanol	600€ - 1000€ per kWh	0.02€ - 0.04€ per kWh	[30,65,134-137]
Mixed alcohols	1200€ - 1600€ per kW	0.05€ - 0.10€ per kWh	[138-142]
Ethanol	1000€ - 1500€ per kW	0.035€ - 0.065€ per kWh	[143-147]
Sustainable aviation fuels	3000€ - 10,000€ per kW	0.65€ – 1.00€ per kWh	[148-150]