Supplementary Materials

Table S1. Properties of the feedstocks.

Properties	Oat straw	Sawdust	Source
Bulk density (kg/m^3)	127.87	158.00	[29,31]
HHV (MJ/kg)	16.84	18.02	[29,31,32]
Cellulose (%)	47.45	41.24	[29,31]
Hemicellulose (%)	24.70	15.72	[29,31,32]
Lignin (%)	12.92	25.16	[29,31]
Ash (%)	5.32	0.54	[29,31]
Other solids (%)	9.61	7.34	[29,31]
Moisture content (%)	10	10	[29,31]

HHV: Higher heating value

Table S2. Cost assumptions and economic evaluation parameters.

Parameters	Value	Source
Time parameters		
Year of analysis	2023	
Currency	US Dollars ($)	
Construction period	12 months	
Startup period	6 months	
Project lifetime	20 years	
Inflation	2%	
Financial parameters		
Depreciation style	Straight line	
Depreciation time	10 years	
Revenue tax rate	40%	
Salvage value	5% of DFC	
Discount rate	10%	
Operating cost		
Operation capacity	90%	
Labor	$ 69/h	SuperPro designer databank
Sawdust	$ 75/t	Antonio et al. [37]
Oat straw	$ 70/t	BIMAT [33]
Nitrogen gas	0.11 / Nm^3	EIA [6]
Selling price of pellet	$60/t - $260/t	[18,26,51]
Selling price of torrefaction liquid	$0.25/L	Badger et al. [27]
Utilities		
Steam (High P)	$ 20/t	SuperPro designer databank
Steam	$ 12/t	SuperPro designer databank
Cooling water	$ 0.05/t	SuperPro designer databank
Electricity	$ 0.1/kW-h	SuperPro designer databank

DFC: Direct fixed capital cost.

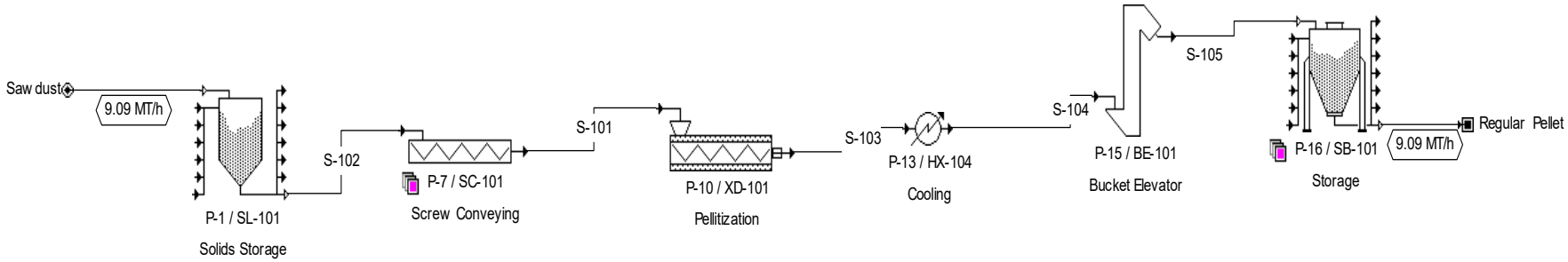

Figure S1. The process of pelleting raw sawdust (Scenario 1).

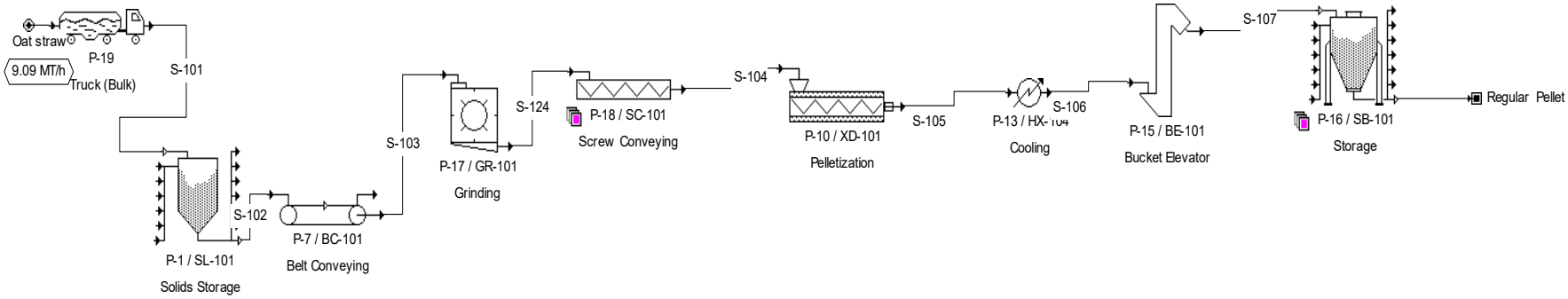

Figure S2. The process of pelleting raw oat straw (Scenario 2).

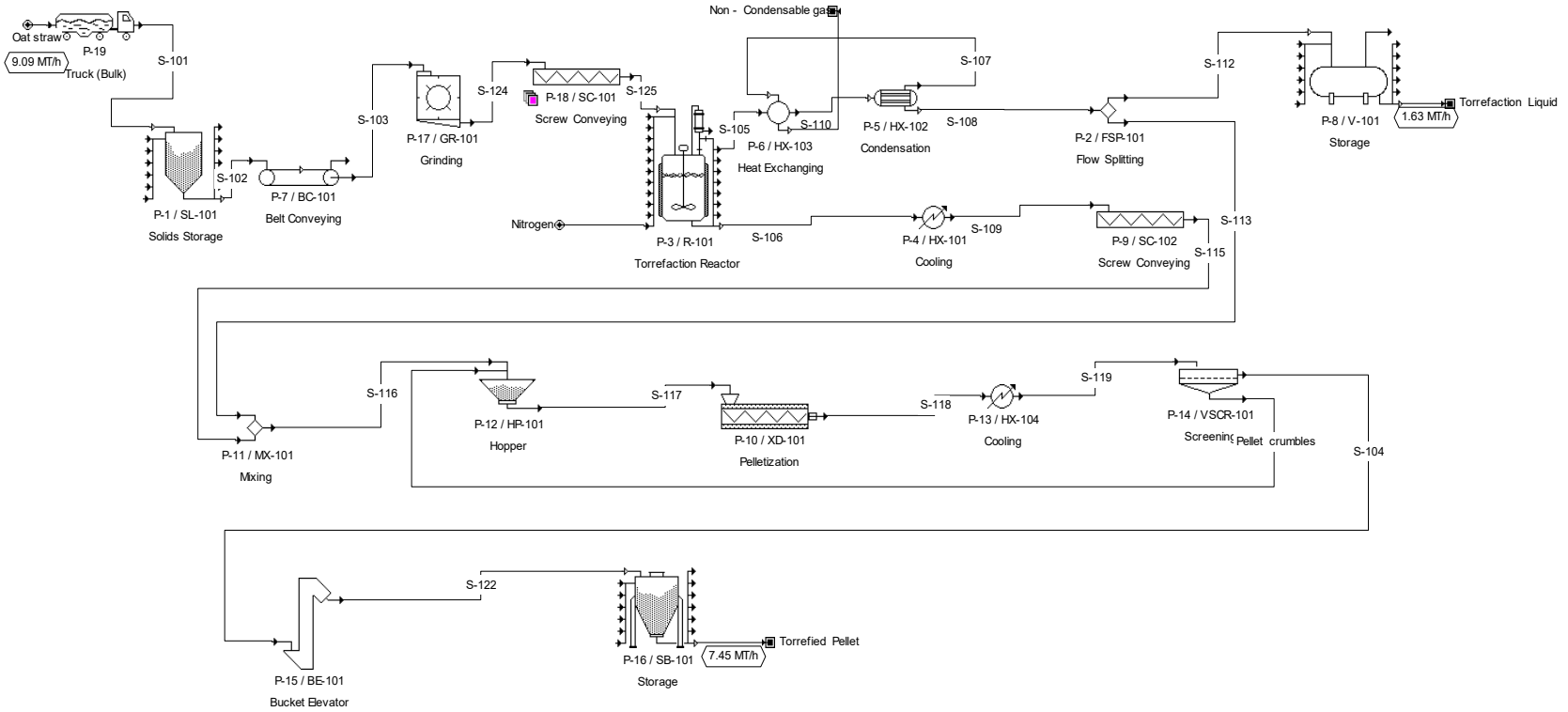

Figure S3. Integrated torrefied treated oat straw pelletization plant utilizing torrefaction liquid (TL) as binder (Scenario 4).

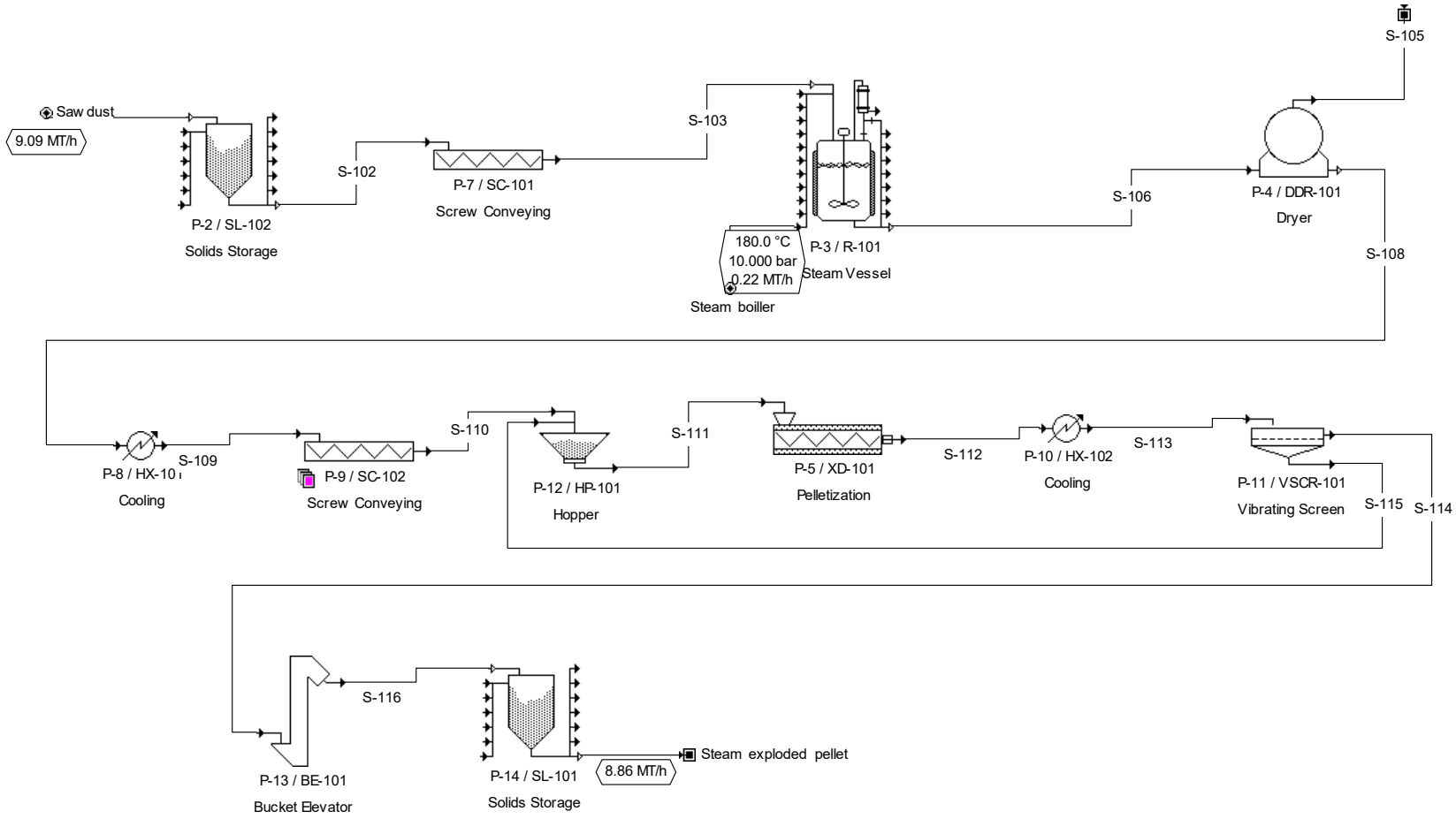

Figure S4. Integrated steam exploded treated sawdust pellet plant (Scenario 5).

Table S3. Major equipment costs (2023 prices in US$) for Scenarios 1 and 2.

Description	**Cost ($) (number of units in parentheses)**	
	Scenario 1	**Scenario 2**
Silo/bin	477,000 (4)	247,000 (2)
Grinder		154,000 (1)
Screw conveyor	176,000 (2)	162,000 (2)
Belt conveyor		177,000 (1)
Pelletizer	212,000 (1)	212,000 (1)
Heat exchanger	23,000 (1)	23,000 (1)
Bucket elevator	20,000 (1)	20,000 (1)
Unlisted equipment	230,000	265,000
Total	**1,148,000**	**1,323,000**

Table S4. Major equipment costs (2023 prices in US$) for Scenarios 3 and 4.

Description	**Cost ($) (number of units in parentheses)**	
	Scenario 3	**Scenario 4**
Silo/bin	477,000 (4)	338,000 (3)
Grinder		301,000 (2)
Screw conveyor	374,000 (4)	254,000 (3)
Torrefaction reactor	3,875.000 (1)	3,875.000 (1)
Condenser	34,000 (1)	34,000 (1)
Flow splitter	163,000 (1)	163,000 (1)
Horizontal tank	48,000 (2)	24,000 (1)
Belt conveyor		789,000 (3)
Pelletizer	185,000 (1)	212,000 (1)
Vibrating screen	33,000 (1)	38,000 (1)
Heat exchanger	420,000 (8)	236,000 (4)
Bucket elevator	20,000 (1)	23,000 (1)
Unlisted equipment	1,410,000	1,572,000
Total	**7,048,000**	**7,859,000**

Table S5. Major equipment costs (2023 prices in US$) for Scenarios 5 and 6.

Description	**Cost ($) (number of units in parentheses)**	
	Scenario 5	**Scenario 6**
Steam generator	638,000 (1)	641,000 (1)
Dryer	131,000 (1)	264,000 (2)
Silo/bin	140,000 (2)	70,000 (1)
Grinder		109,000 (1)
Screw conveyor	272,000 (3)	275,000 (3)
Belt conveyor		263,000 (3)
Pelletizer	273,000 (1)	273,000 (1)
Vibrating screen	13,000 (1)	12,000 (1)
Heat exchanger	210,000 (4)	363,000 (6)
Bucket elevator	23,000 (1)	23,000 (1)
Unlisted equipment	425,000	535,000
Total	**2,125,000**	**2,675,000**