



SAMROM. CG

CHP 2.4 & 3.0 MWe BIOMASS GASIFICATION PLANT

OFFER N° 05/15

FOR MR. ALFRED FREH

CONCEPTUAL & PRELIMINARY

September 2015.



SAMROM. CG

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1.0. SUBJECT

Subject of Quotation is Preliminary Budgetary Offer for CHP Plant with total electrical output of 2,4 MWe or 3 MWe.

Preliminary technical solutions are given for both value of electrical output.
Preliminary budgets are given on Turn-key basis, for both variant solutions.
Calculation of statically economic criteria ROI (Return On Investment) is done according to input data obtained by Client and Estimated budgets for project.

2.0. BASIC AND INPUT DATA

Basic Data:

Technology:	Biomass Gasification in GRE Dual Circulating Fluidized Bed Reactor
Output:	Variant 1: 2,4 MWe of Electrical Power Variant 2: 3.0 MWe of Electrical Power (With ORC Turbine)
Offer Type:	Preliminary and Budgetary, Turn -Key (EPCC - Engineering, Procurement, Construction & Commissioning)

Input data by Client

Fuel:	Wood Chips as biomass feed stock with max. 40 % moisture content Type of Wood: Beech, Oak, Pine
LH V of fuel with 40 % mw (kWh/kg)	2.60
Price of Chips /Fuel (EUR/t dry)	100.00
FIT for Electrical Energy (EUR/MWh)	120.00
FIT/Price for Thermal Energy (EUR/MWh)	60
Consumables	
• Olivine (EUR/kg)	0.08
• Dolomite (EUR/kg)	0.05
• Fuel oil (EUR/l)	0.50
• Biodiesel (EUR/l)	0.50
• Nitrogen (EUR/Nm ³)	0.13
• Engine oil (EUR/l)	4.00
Staff - Salaries	
• Plant Manager (EUR/month)	2000
• Operators (EUR/month)	1000



3.0. DESCRIPTION OF OFFERED SOLUTION

The core of the GRE DFB gasification plant is formed by the two inter-connected fluidized bed systems of the fluidized bed steam gasifier (reactor).

In the gasification zone small pieces of biomass are fluidized by steam and gasified under anaerobic conditions at approx. 850°C. The bed material (olivine sand) has the function of a heat transfer medium and provides a stable temperature in the reactor.

In the next step the resultant product gas is purified and cooled.

The heat from this process step can drive an ORC to produce electricity. Residual heat can be fed into a district heating network, heat from the district heating return is used for drying feedstock to 15 - 20% moisture content before feeding it into the plant. After cooling, dust is filtered from the gas and tar is washed out with biodiesel.

During gas purification neither solid waste nor waste water arises, and the product gas is completely free from nitrogen. Fluidized bed steam gasifiers work extraordinarily reliably and regularly (7,000-8,000 operating hours per annum) and are considered state-of-the-art (Best Available Technology).

The basic process diagram of a GRE DFB gasification plant is shown in figure 1.

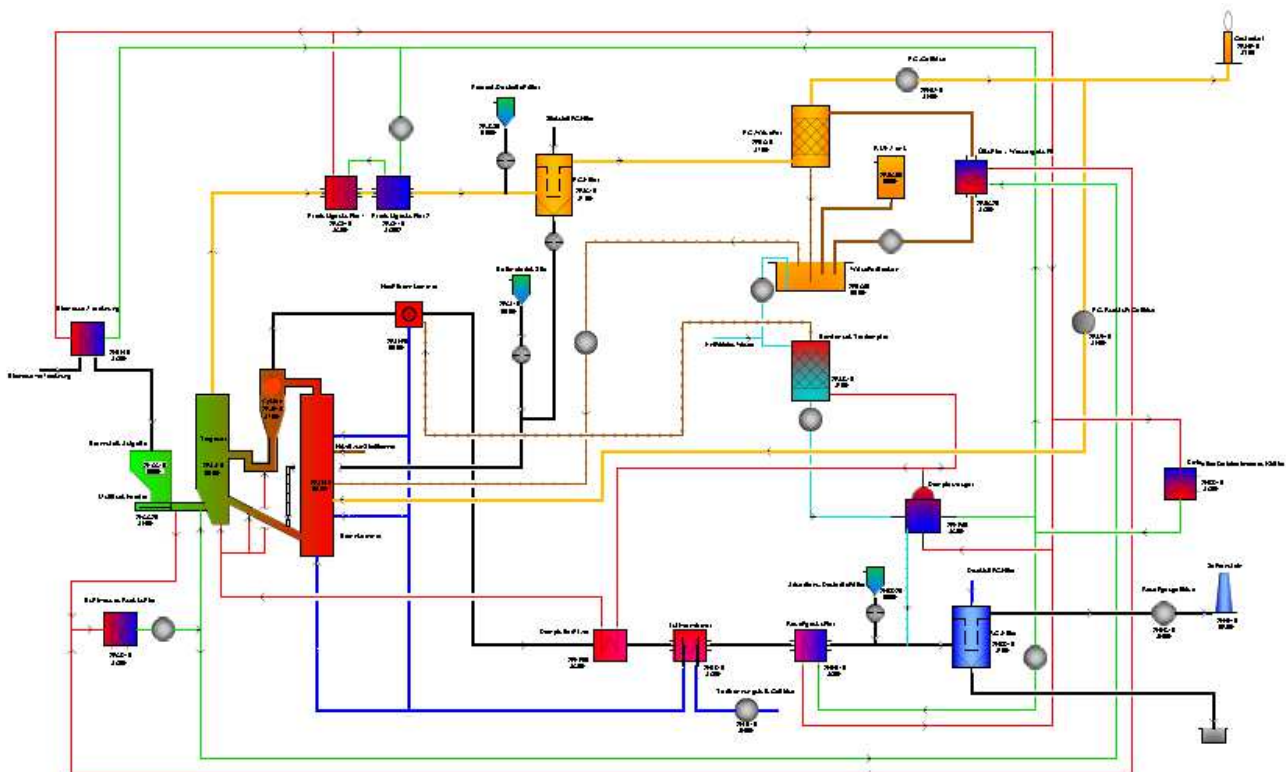


Figure 1. The basic process diagram of Gussing Gasification Plant

3.1. Option 1: CHP 2.4 MWe

Mass and Energy Balance of 2.4 MWe CHP Plant is shown in figure 2 and in drawing P.05.15.01.1 in attachments of this Preliminary Offer.

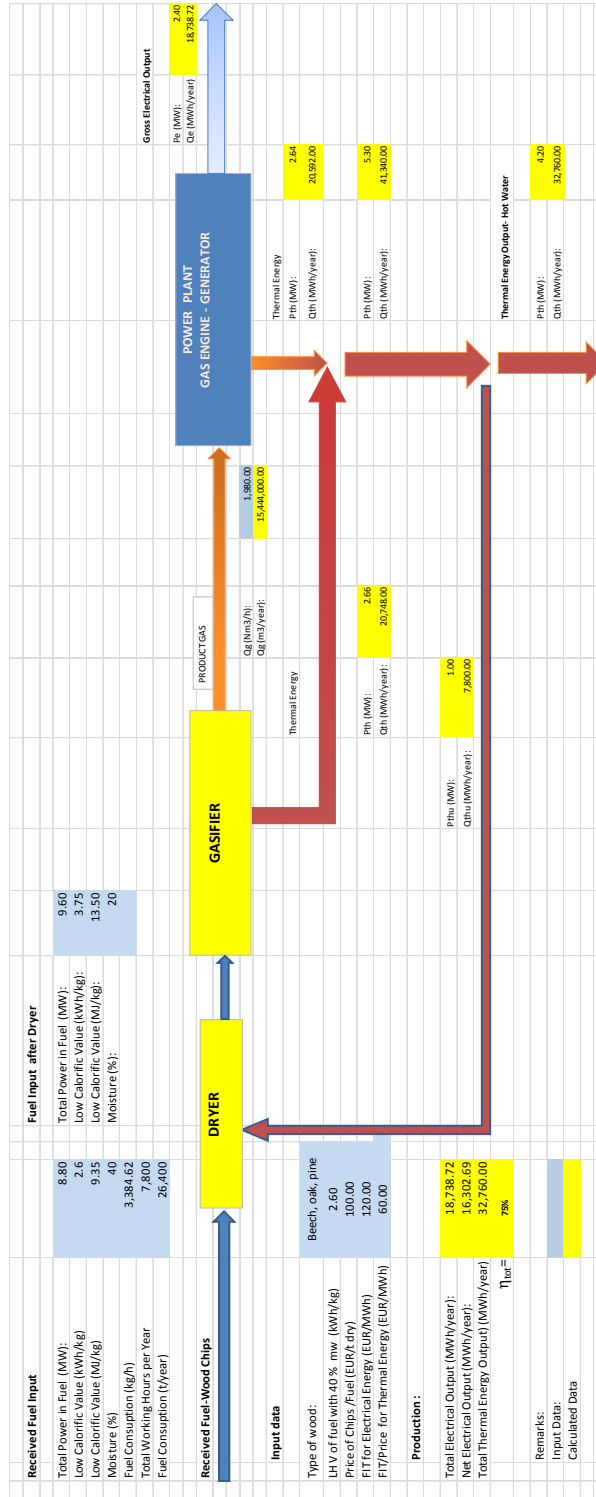


Figure 2. Mass and Energy Balance

3.2. Option 2: CHP 3.0 MWe

Mass and Energy Balance of 3.0 MWe CHP Plant is shown in figure 3 and in drawing P.05.15.01.2 in attachments of this Preliminary Offer.

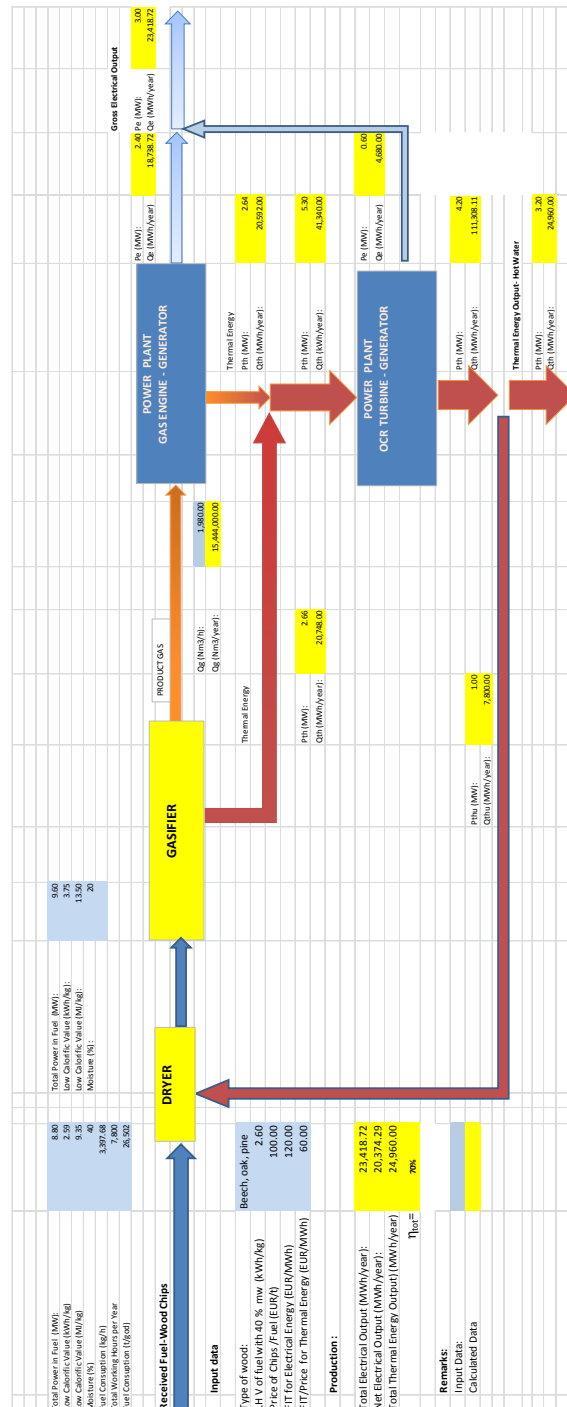


Figure 3. Mass and Energy Balance

Process diagrams of complete CHP plant is shown in drawing P.05.15.02.1 for Option 1 in drawing P.05.15.02.2. for Option 2. Layouts with required space for CHP plant is shown in drawing P.05.15.03.1 for Option 1 and in drawing P.05.15.02.2. for Option 2.



4.0. PRELIMINARY BUDGET

Preliminary and Budgetary Costs of CHP plants on Turn -Key basis (EPCC - Engineering, Procurement, Construction & Commissioning)are:

- Option 1: 10,600,000.00 EUR
- Option 2: 12,000,000.00 EUR

5.0. ROI CALCULATION

5.1. Option 1: CHP 2.4 MWe

Input data for ROI calculation for Option 1 are shown in Table 1.

Table 1. Input data for Option 1

Input data		
	Type of wood:	Beech, oak, pine
	LHV of fuel with 40 % mw (kWh/kg) (2.60
	Price of Chips /Fuel (EUR/t dry)	100.00
	FIT for Electrical Energy (EUR/MWh)	120.00
	FIT/Price for Thermal Energy (EUR/MWh)	60.00
	INVESTMENT (EUR)	10,600,000.00
	Production :	
Insgesamt	Total Electrical Output (MWh/year):	18,738.72
Netto	Net Electrical Output (MWh/year):	16,302.69
Insgesamt	Total Thermal Energy Output) (MWh/year)	32,760.00

Calculation of OPEX for Option 1 is shown in Table 2.

Table 2. OPEX for Option 1

PRODUCTION COST			
Consumables	Consumption	EUR/j.m	EUR/god)
# Fuel -Wood Chips (t/year)	26,400.00	60.00	1,584,000.00
# Olivine (kg/h)	33.00	0.08	20,592.00
# Dolomite (kg/h)	15.00	0.05	5,850.00
#Fuel oil (l/year)	15,000.00	0.50	7,500.00
# Biodiesel (l/h)	15.00	0.50	58,500.00
# Nitrogen (Nm3/h)	70.00	0.13	73,164.00
# Engine oil (l/god)	1,600.00	4.00	6,400.00
		Total:	1,756,006.00
STAFF			
	No of employees	EUR/month	EUR/year
# Plant Manager	1	2,000.00	24,000.00
# Operators	5	1,000.00	60,000.00
		Total:	84,000.00
OPEX:			
# Production Cost (EUR/year)		1,756,006.00	Service
# Maintenance Cost (EUR/year)		144,000.00	
# Staff (EUR/year)		84,000.00	
TOTAL OPEX (EUR/year)		1,984,006.00	

Calculation of total incomes for Option 1 is shown in Table 3.

Table 3. Total incomes for Option 1

TOTAL INCOME	
Total Income - Electrical Energy (EUR/year)	1,956,322.37
Total income - Thermal energy (EUR/year)	1,965,600.00
TOTAL INCOME (EUR):	3,921,922.37

Euro



Calculation of ROI and Payback Period for Option 1 is shown in Table 4. Capital gains are taxed as ordinary income at the standard corporation tax rate in Poland of 19 %.

Table 4. ROI Calculation

Gross Profit (EUR/year)	1,937,916.37	Vorsteuer
Net Profit (EUR/year)	1,569,712.26	Netto
ROI (%)	16.35	Rendite
Payback Period (Year):	6.12	Amorization

5.2. Option 2: CHP 3.0 MWe

Input data for ROI calculation for Option 2 are shown in Table 5.

Table 5. Input data for Option 2

Input data	
Type of wood:	Beech, oak, pine
LHV of fuel with 40 % mw (kWh/kg) (2.60
Price of Chips /Fuel (EUR/t dry)	100.00
FIT for Electrical Energy (EUR/MWh)	120.00
FIT/Price for Thermal Energy (EUR/MWh)	60.00
INVESTMENT (EUR)	12,000,000.00
Production :	
Total Electrical Output (MWh/year):	23,418.72
Net Electrical Output (MWh/year):	20,374.29
Total Thermal Energy Output) (MWh/year)	24,960.00

Calculation of OPEX for Option 2 is shown in Table 6.

Table 6. OPEX for Option 2

PRODUCTION COST			
Consumables	Consumption	EUR/j.m	EUR/god)
# Fuel -Wood Chips (t/year)	26,501.93	60.00	1,590,115.83
# Olivine (kg/h)	33.00	0.08	20,592.00
# Dolomite (kg/h)	15.00	0.05	5,850.00
#Fuel oil (l/year)	15,000.00	0.50	7,500.00
# Biodiesel (l/h)	15.00	0.50	58,500.00
# Nitrogen (Nm3/h)	70.00	0.13	73,164.00
# Engine oil (l/god)	1,600.00	4.00	6,400.00
		Total:	1,762,121.83
STAFF			
	No of employees	EUR/month	EUR/year
# Plant Manager	1	2,000.00	24,000.00
# Operators	5	1,000.00	60,000.00
		Total:	84,000.00
OPEX:			
# Production Cost (EUR/year)			1,762,121.83
# Maintenance Cost (EUR/year)			165,000.00
# Staff (EUR/year)			84,000.00
TOTAL OPEX (EUR/year)			2,011,121.83

Calculation of total incomes for Option 2 is shown in Table 7.

Table 7. Total incomes for Option 2

TOTAL INCOME	
Total Income - Electrical Energy (EUR/year)	2,444,914.37
Total income - Thermal energy (EUR/year)	1,497,600.00
TOTAL INCOME (EUR):	3,942,514.37



Calculation of ROI and Payback Period for Option 2 is shown in Table 8. Capital gains are taxed as ordinary income at the standard corporation tax rate of 19 %.

Table 8. ROI Calculation

Gross Profit (EUR/year)	1,931,392.54
Net Profit (EUR/year)	1,564,427.96
ROI (%)	14.22
Payback Period (Year):	7.03

6.0. CONCLUSIONS

- Both Options have acceptable values of ROI.
- Option 1 has a higher value of ROI, which is unusual and caused by very low FIT of electrical power.
- Calculation of ROI is done with very high price of wood chips of 100 EUR/t dry.

7.0. ATTACHMENTS

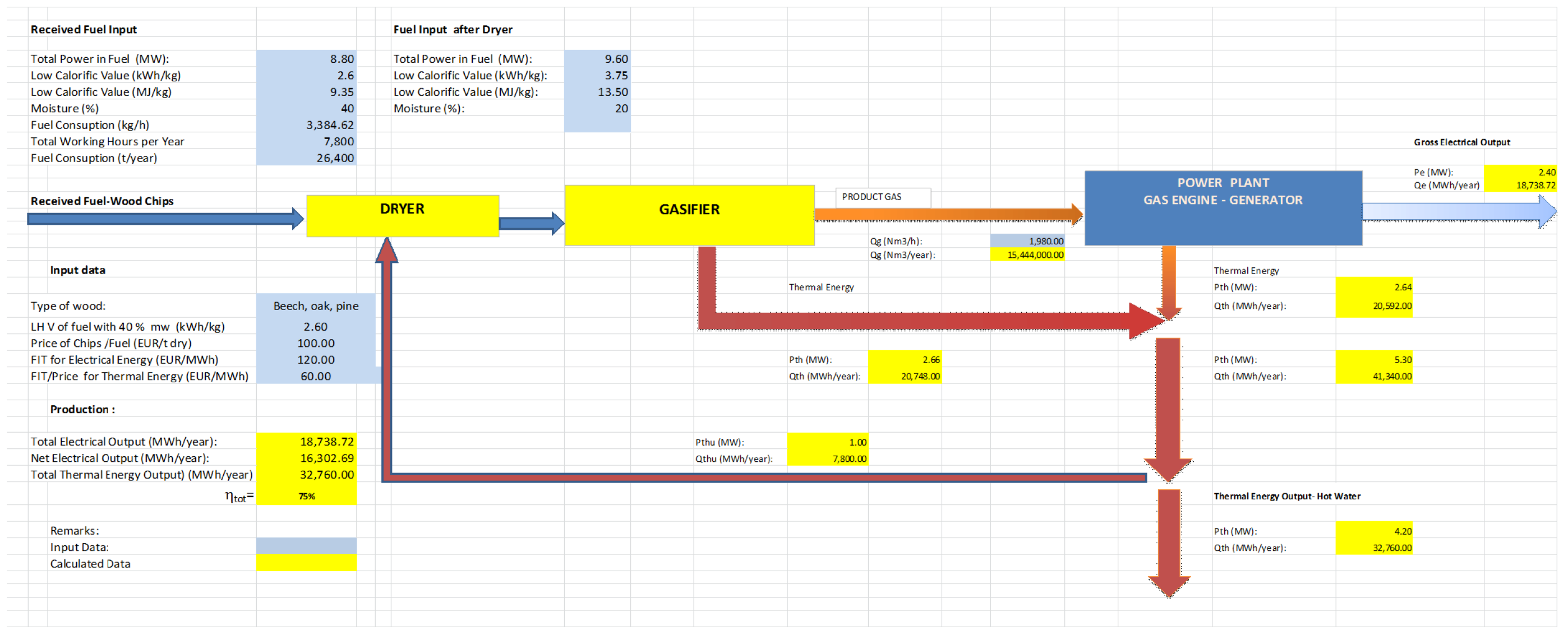
Option 1 - Drawings:

- Drawing P.05.15.00.1. Mass and Energy Balance
- Drawing P.05.15.01.1. Process Diagram
- Drawing P.05.15.02.1. Layout of the Plant

Option 2 - Drawings:

- Drawing P.05.15.00.2. Mass and Energy Balance
- Drawing P.05.15.01.2. Process Diagram
- Drawing P.05.15.02.2. Layout of the Plant



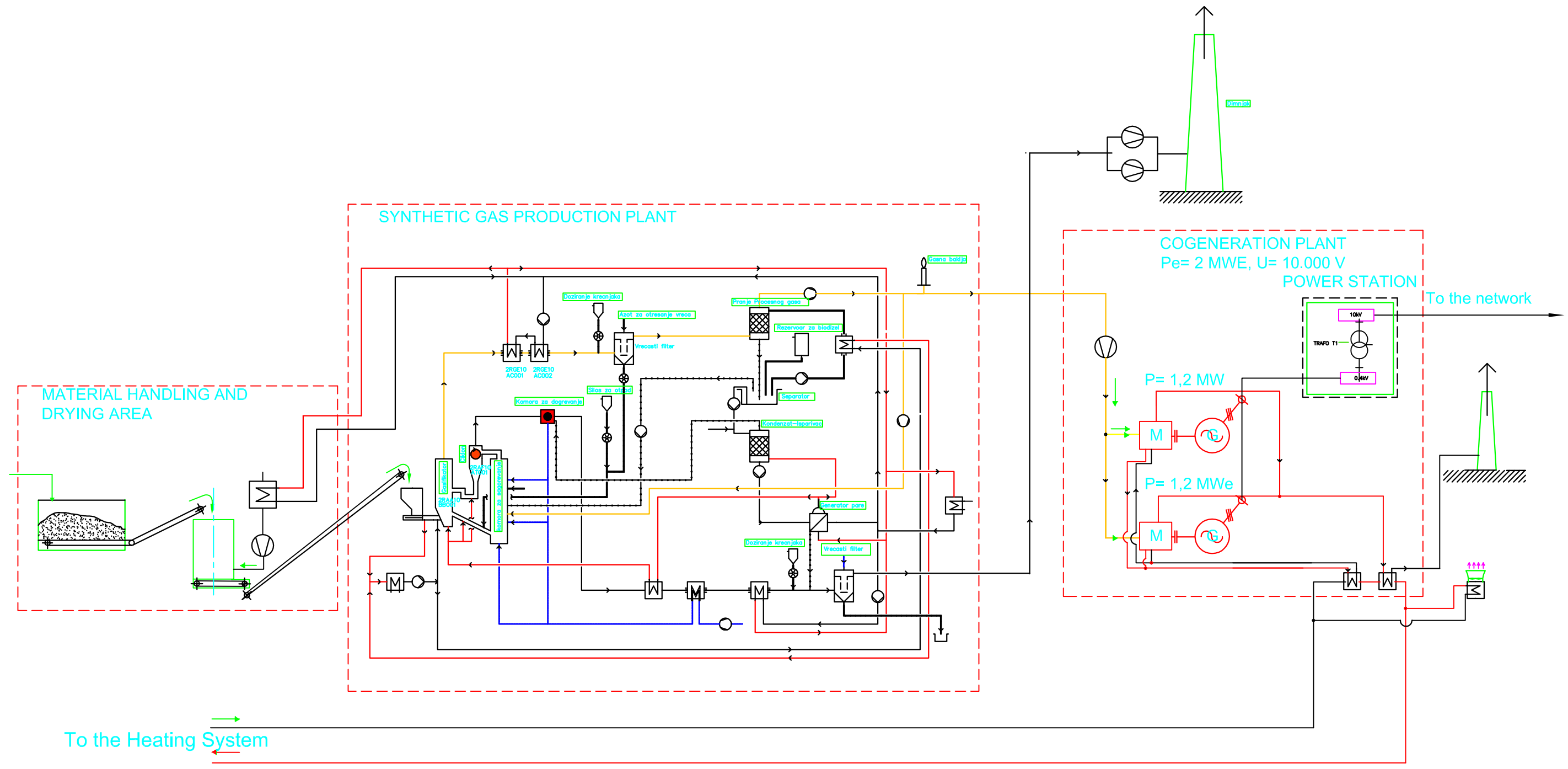


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SAMROM. CG		Client: XXXXXXXXXXXXXXXXXX	Project No: GREE P 05-15
Date	Name	Signature	Plant: CHP 2,4 MWe MS
Designed	VIII 2015.	M.S.	Location: XXXXXXXXX
Drawn			Project: XXXXXXXXXXXXXXXXXXXXX
Checked	VIII 2015.		
Approved	XII 2015.	A.J.	
Scale:	Naziv crteža:		Drawing No:
x : y	BALANCE OF MASS AND ENERGY		P.05.15.00.1
Rev. No.	Description of Modification	Date	Name
Connection with other drawings :		P=	Rev. No: xx

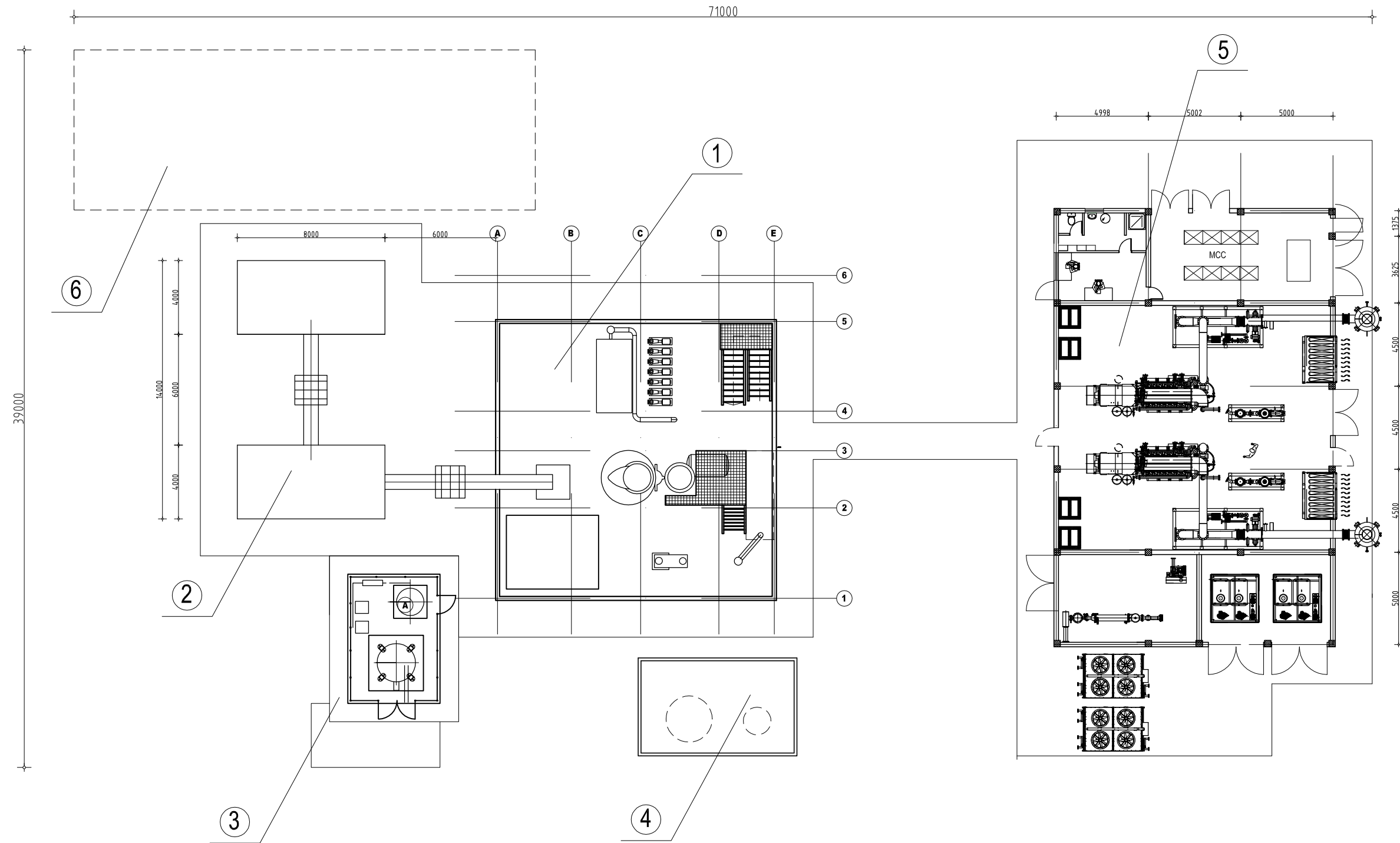
Rev. No.	Description of Modification	Date	Name

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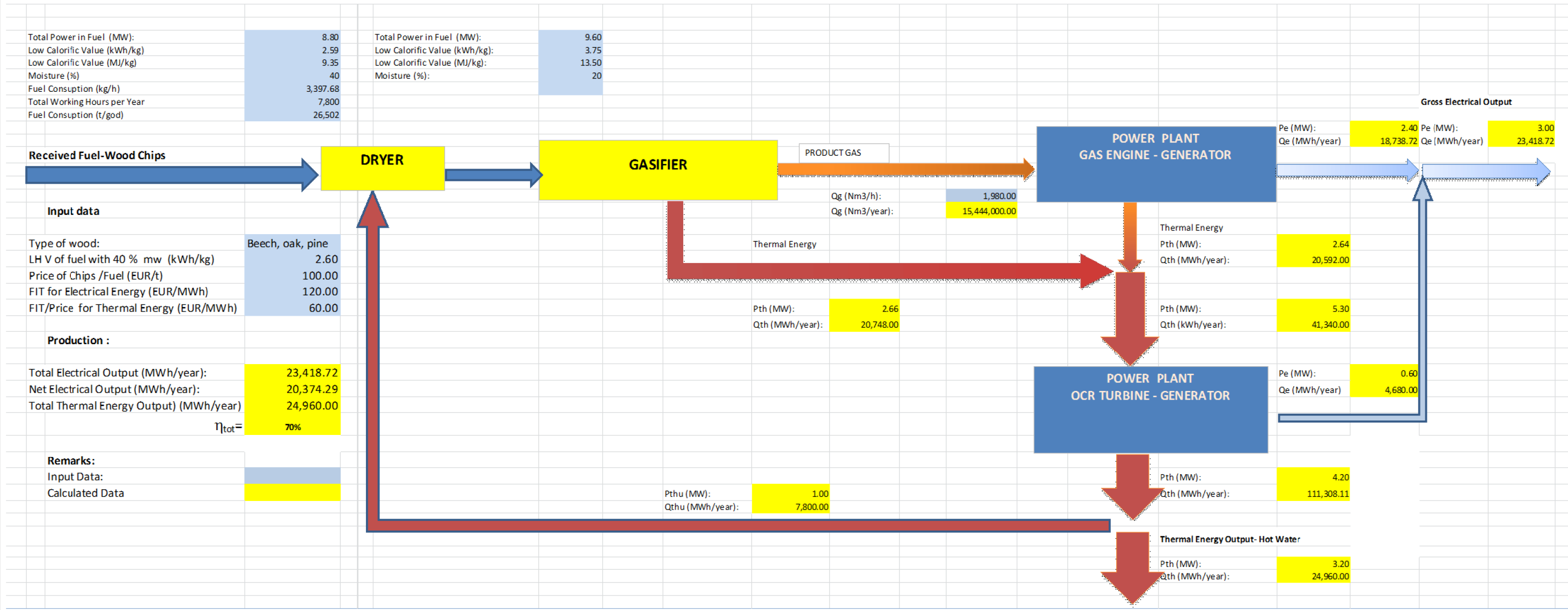
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		Date	Name	Signature	Plant: CHP 2,4 MWe MS	
	Designed	VIII 2015.	M.S.		Location: XXXXXXXXX	
	Drawn				Project: XXXXXXXXXXXXXXXXXXXXX	
	Checked	VIII 2015.				
	Approved	XII 2015.	A.J.			
	Scale:	Naziv crteža:			Drawing No:	Drawing Size:
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Rev. No.	Description of Modification	Date	Name	Connection with other drawings :	P=	Sheet:x Sheets::
						Rev. No: xx



- 1 - GASIFICATION PLANT
- 2 - DRYING AND MATERIAL HANDLING
- 3 - NITROGEN SUPPLY STATION
- 4 - OIL AND BIO-DIESEL STATION
- 5 - POWER STATION
- 6 - BIOMASS STORAGE AREA

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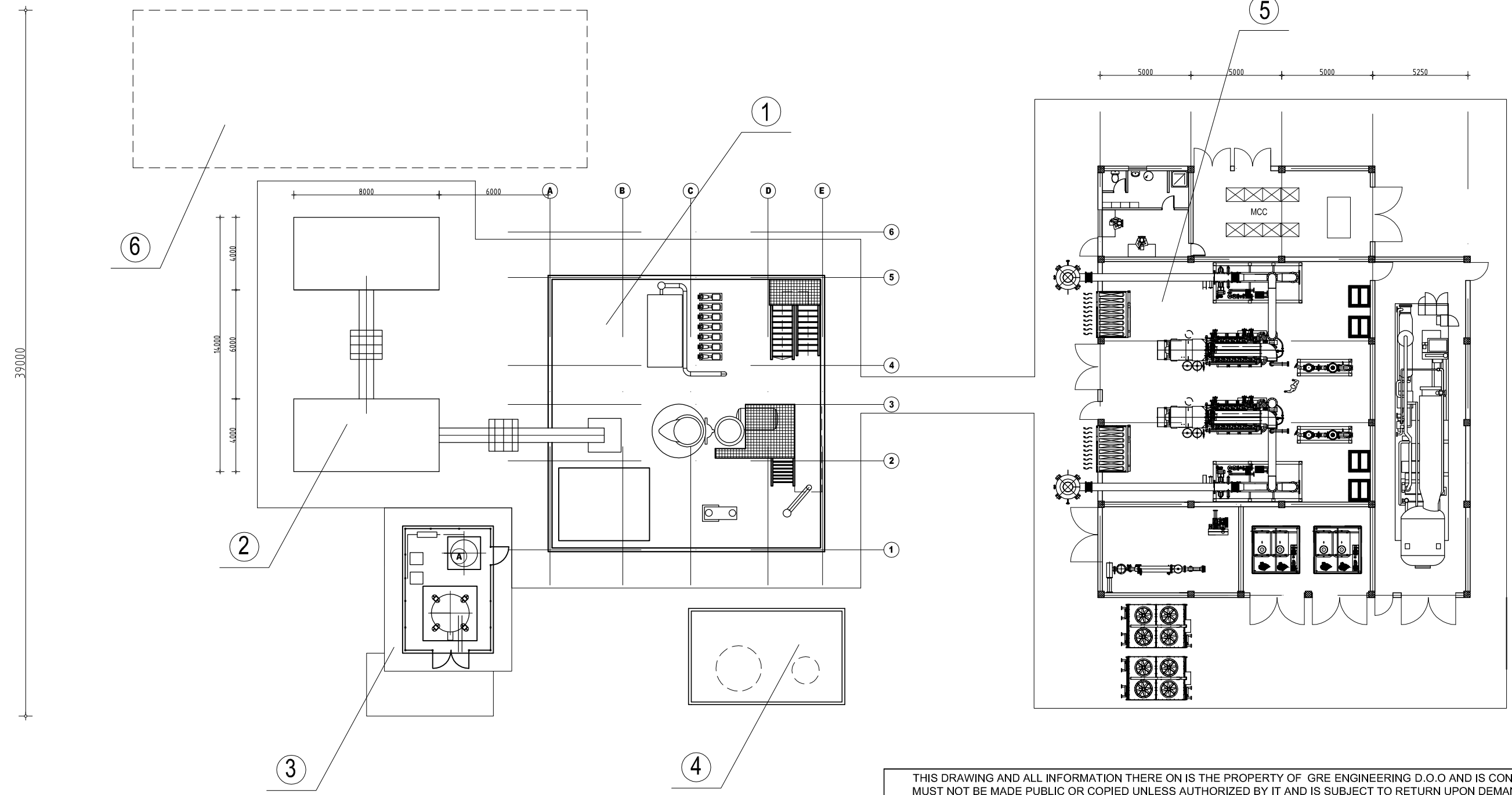
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		Plant: CHP 2,4 MWe MS	Location: XXXXXXXXX	Project: XXXXXXXXXXXXXXXXXXXXX	
Designed	VIII 2015.	M.S.	Signature		
Drawn					
Checked	VIII 2015.				
Approved	XII 2015.	A.J.			
Scale:	Naziv crteža:			Drawing No:	Drawing Size:
x : y	LAYOUT OF CHP 2,4 MWe PLANT			P.05.15.02.1	A3
Rev. No.	Description of Modification	Date	Name	Connection with other drawings :	P= m ₁ Sheet:x Sheets:: Rev. No: xx



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SAMROM. CG		Client: XXXXXXXXXXXXXXXXXX	Project No: GREE P 05-15
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	Date	Name	Signature	Plant: CHP 3,0 MWe MS-TS
Designed	VIII 2015.	M.S.		Location: XXXXXXXXX
Drawn				Project: XXXXXXXXXXXXXXXXXXXXX
Checked	VIII 2015.			
Approved	XII 2015.	A.J.		
Scale:	Naziv crteža:			Drawing No:
x : y	BALANCE OF MASS AND ENERGY			P.05.15.00.2
Rev. No.	Description of Modification	Date	Name	Drawing Size: A3
Connection with other drawings :				Rev. No: xx



- 1 - GASIFICATION PLANT
- 2 - DRYING AND MATERIAL HANDLING
- 3 - NITROGEN SUPPLY STATION
- 4 - OIL AND BIO-DIESEL STATION
- 5 - POWER STATION
- 6 - BIOMASS STORAGE AREA

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<p style="text-align: center;">SAMROM. CG</p>		Client:	Project No:	
		XXXXXXXXXXXXXXXXXX	GREE P 05-15	
	Date	Name	Signature	Plant: CHP 2,4 MWe MS
Designed	VIII 2015.	M.S.		Location: XXXXXXXXX
Drawn				Project: XXXXXXXXXXXXXXXXXXXXX
Checked	VIII 2015.			
Approved	XII 2015.	A.J.		
Scale:	Naziv crteža:			Drawing No:
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Rev. No.	Description of Modification	Date	Name	Drawing Size:
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Connection with other drawings :				P=
				m ₁ Sheet:x Sheets::
				Rev. No: xx