



Glycerine – AVE System

From Waste to Steam

About Bectel

➤ Bectel Engineers:

- ✓ Global Engineering
- ✓ Equipment Supplier
- ✓ General Contractor

➤ Industrial Sectors:

- ✓ Chemical & Petrochemical
- ✓ Pharmaceuticals & Biotechnology
- ✓ Environment
- ✓ Power industries & Renewable Energy



Bectel Green Energy know-how & experiences

Biofuels:

- AVE glycerine process plants
- Biodiesel transesterification process plants
- Biofuel adjustment to EN 14214 process plants



Renewable Energies :

- VEB biomass process plants
- Solar hybridization power plants
- WTG processes - waste to gas, available for:
 - ✓ DIBIO process to transform to Biogas
 - Fleet consumption and Power generation
 - ✓ BTE process to transform to Syngas for
 - Power generation
 - GTL process – Gas to Liquid
 - 2G biofuels (Fischer Tropsch)



Bectel and the biofuels

➤ Consulting

- ✓ Oils and Biofuels market research
- ✓ Strategic studies
- ✓ Economical evaluations



➤ Engineering

- ✓ Process packages design
- ✓ Basic and Detailed Engineering
- ✓ Procurement
- ✓ Construction Management
- ✓ Commissioning and start-up
- ✓ Training



➤ EPC and EC

- ✓ Turnkey Plants: Engineering, Procurement and Construction



European Biodiesel Market

- Europe Biofuel production according Directive 200/30/CE (5,75% blending-2010)

	<u>2006</u>	<u>2008</u> Forecast	<u>2010</u> Forecast
Metric Tons/year	4.890.000.-	10.000.000.-	15.000.000.-

- Europe Crude Glycerine (83% biofuel byproduct)

	<u>2006</u>	<u>2008</u>	<u>2010</u>
Metric Tons/year	*490.000.-	1.000.000.-	1.500.000.-

Note:

These quantities are based in the average amounts from usual sources.

*(Europe demands 2006 - 250.000 Metric Tons)

Glycerine market

Traditional producers were lipids, oil & fat processors

➤ Leading Glycerine producers

- Procter & Gamble
- Dow Chemical
- Uniquema
- Cognis
- Vitusa Products
- etc.

➤ The largest markets for Glycerine

- Personal care
- Cosmetics
- Polyurethanes
- Pharmaceuticals
- Food
- etc.

➤ Demand for Glycerine (2008)

- Worldwide  900.000 Metric Tons
- Europe  350.000 Metric Tons

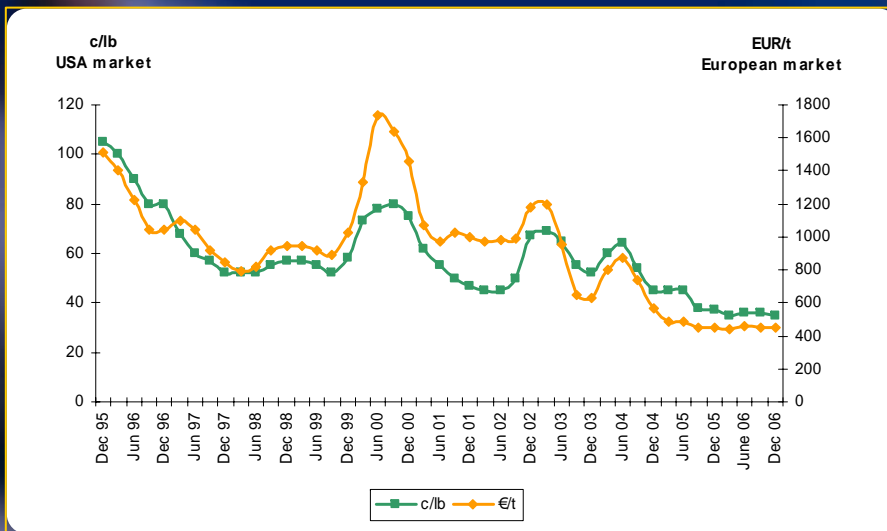
Glycerine market

Glycerine Prices (2006-2007)

- Pharma uses (glycerol 99,7%) 150 to 180 €/Tn
- Biofuel Byproduct (glycerol 83%) 0 to 50 €/Tn

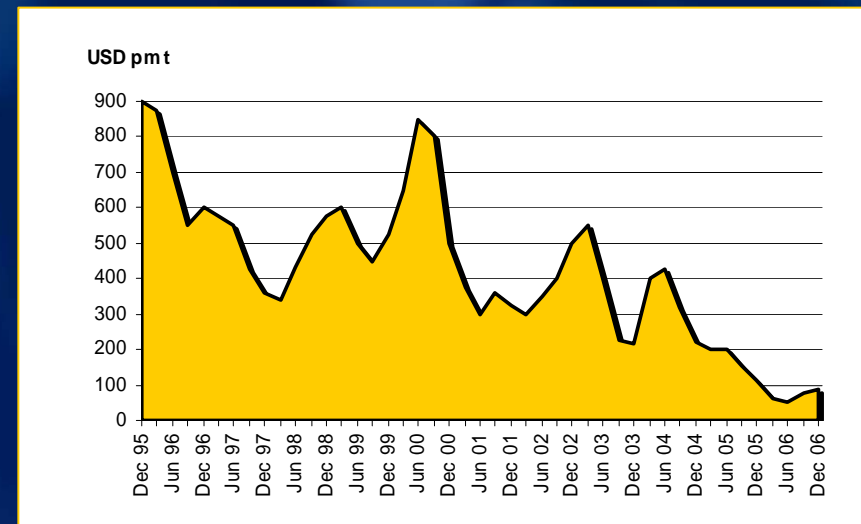
Glycerine Prices (2008 / 2009 forecast)

- Biofuel Byproduct (83% glycerol) - 100 to 0 €/Tn



USA and EU prices evolution for "Kosher" quality 99,7%
1995-2006

*(Source European Biodiesel Board)



Europe prices evolution for 80% quality (crude glycerine*)
in USD pmt, 1995-2006

*(Source European Biodiesel Board)

Conclusion

➤ Excess of Glycerine in Europe

2008	650.000 M Tn
2010	1.400.000 M Tn

There are serious doubts to use it in Drugs & Food chain Industry

- It's not possible to absorb all glycerine generated
- Glycerine comes from chemical (not physical) reactions with possible presence of :
 - Salts, methanol (toxic), acids (neutralisation) , etc.
 - Used Oils and / or Animal Fats
- New toxic raw materials
 - JATROPHA CURCAS
 - Others

Conclusion

What can we do with it?

- Development of new processes (R+D) for new treatments and new chemical uses (5-10 years: 2012 ... 2018)
- Bectel / AVE Glycerine Energy plant (In operation)



R+D Future Solutions

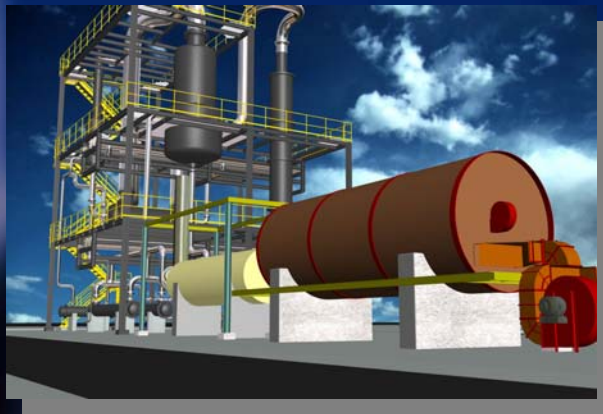


AVE Plant Present Solution

bectel / AVE - Glycerin Energy Plant

Energetic Valuation of Crude Glycerine

- The most profitable reality for the biodiesel Glycerine
- From Waste to Steam
- Generates over 100% of steam requirements of your refining & transesterification Plant only with own produced glycerine
- Free & Green energy. Doesn't need supplementary fuel to work



bectel / AVE - Glycerin Energy Plant

- After 3 years of design & tests works, development in Pilot Plant, and, production in industrial scaled plant...

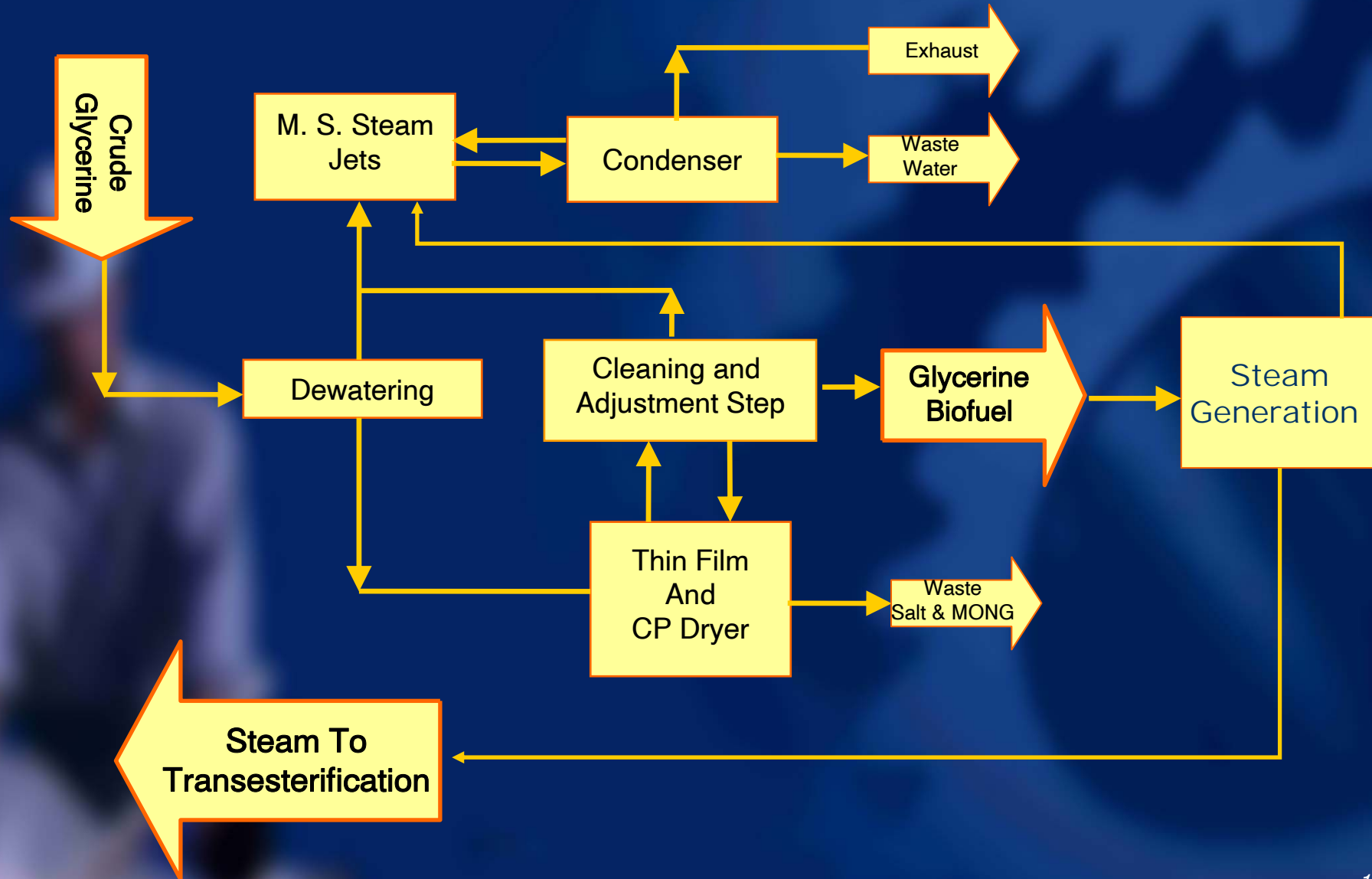
... **bectel AVE** technology offers:

- System life over decades, working **8.000 hours / year**
- **Combustion free of ashes** and melted salts that could stick, corrode and break mechanical equipments
- **Doesn't need auxiliary fuel** to assure a complete combustion
- Clean emissions guaranteed, **free of acroleins and other toxics**.
 - CO <40ppm; <0,79mg/Nm³
 - Nox <13ppm; 35,47 mg/Nm³
 - SO₂ <1ppm; 18,92 mg/Nm³
 - COVs = 0
 - Particles <10 mg/Nm³
- Energy Production with **NO green-house gas emissions** (CO₂) in a 90%.
- **Economical Energy**, based in only crude glycerine, without supplementary fuels
- **Saves** investment in steam boilers

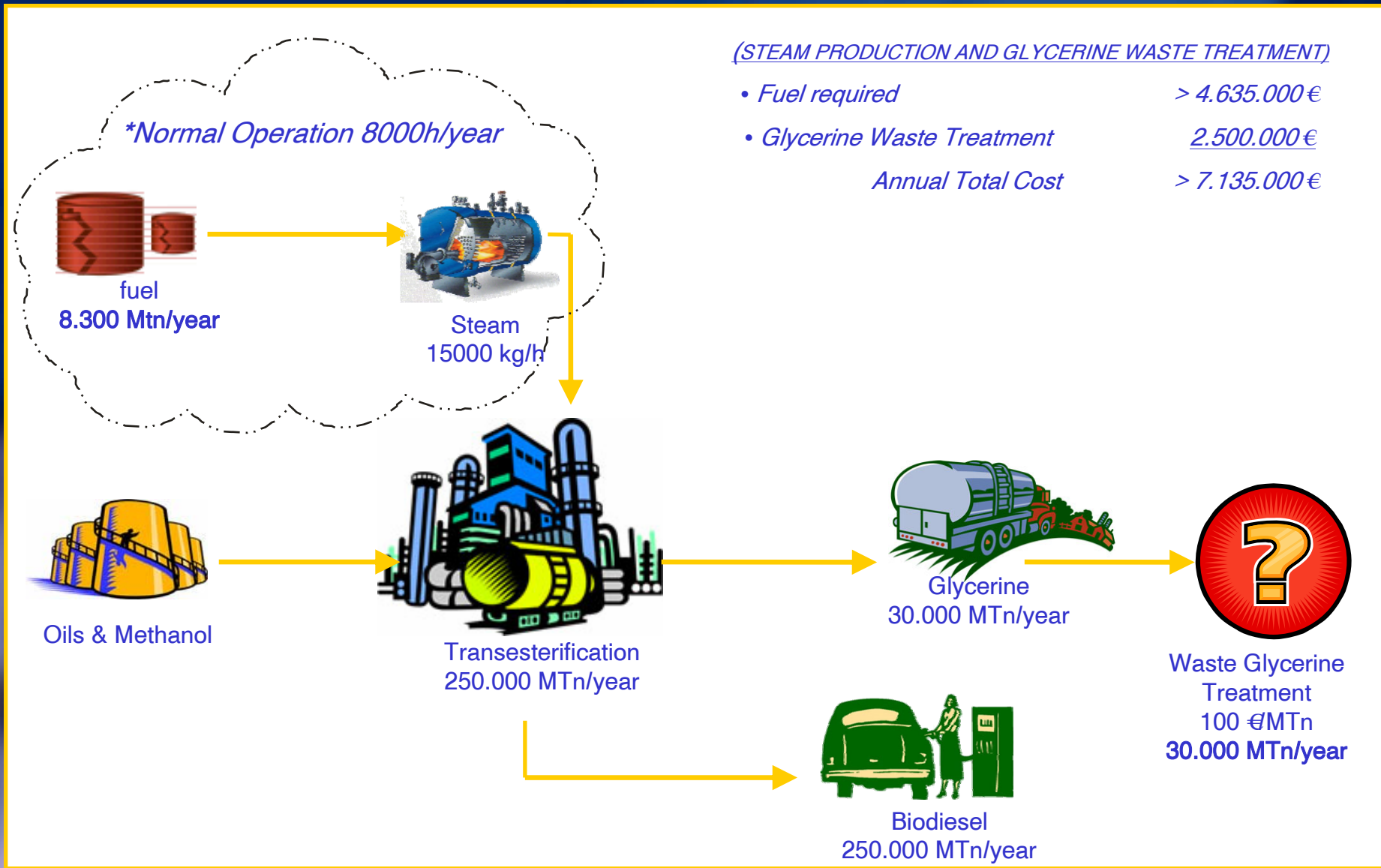
bectel / AVE - Glycerin Energy Plant

Biodiesel Production Plant			
• FAME plant Size (MTn/year)	100.000	150.000	250.000
• Factory work (h/year)	8.000	8.000	8.000
• Crude glycerine flow (kg/h)	1.500	2.250	3.750
AVE features			
• biofuel-glycerine flow (kg/h)	1.271	1.907	3.178
• Saturated Steam production at 14 barg	6.500	9.800	16.300
• CO ₂ saved (MTn/year)	7.000	10.500	17.500
• Electrical power (kW)	105	132	186
• Required Area (m ²)	150	200	250

bectel / AVE - Glycerin Energy Plant



FAME Production Plant 250k - (Without AVE Plant)

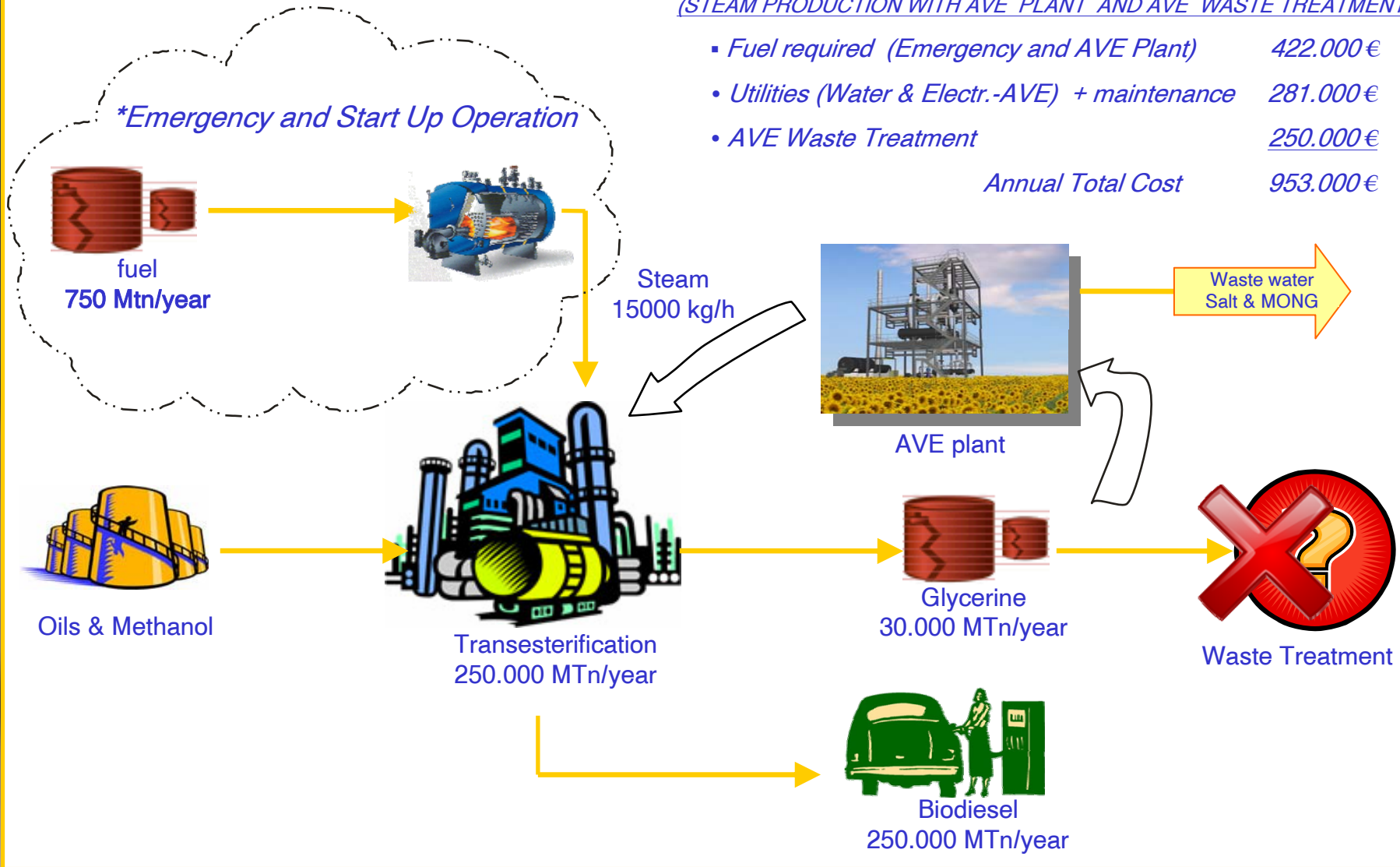


FAME Production Plant 250k - (With AVE Plant)

(STEAM PRODUCTION WITH AVE PLANT AND AVE WASTE TREATMENT)

- Fuel required (Emergency and AVE Plant) 422.000 €
- Utilities (Water & Electr.-AVE) + maintenance 281.000 €
- AVE Waste Treatment 250.000 €

Annual Total Cost 953.000 €



FAME Production Plant (Utilities Annual Cost)

Annual Balance	FAME Production Plant	
	Without AVE	With AVE (Steam)
FAME production Plant Size (Tn/Year)	250.000	250.000
Steam Required (kg/h)	15.000	16.300
Fuel Required to steam Production (€)	4.635.000	422.560 ^{*(2)}
Water Treatment (€)		23.000 ^{*(2)}
Electricity Required (€)		96.000 ^{*(2)}
Waste Treatment (€)	2.500.000 ^{*(1)}	250.000 ^{*(2)}
Maintenance (€)		162.000 ^{*(2)}
Total Annual Cost (€)	7.135.000	953.560
Anual Profit (€)		6.181.440

Notes:

^{*(1)} Waste Treatment Recycle Plant – 100€Tn

^{*(2)} AVE Utilites and Waste Treatment Plant



Thank you for your attention

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