بسم الله الرحمن الرحيم

محطة طاقة كهربائية عن طريق حرق النفايات بحجم

1.5 MW

المواصفات الفنية

NLAP 1.5 MW Incineration Power Plant

Technichal Specification

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طاقة الشمال

North Lebanon Alternative Power

www.nlap-lb.com

Name of document:

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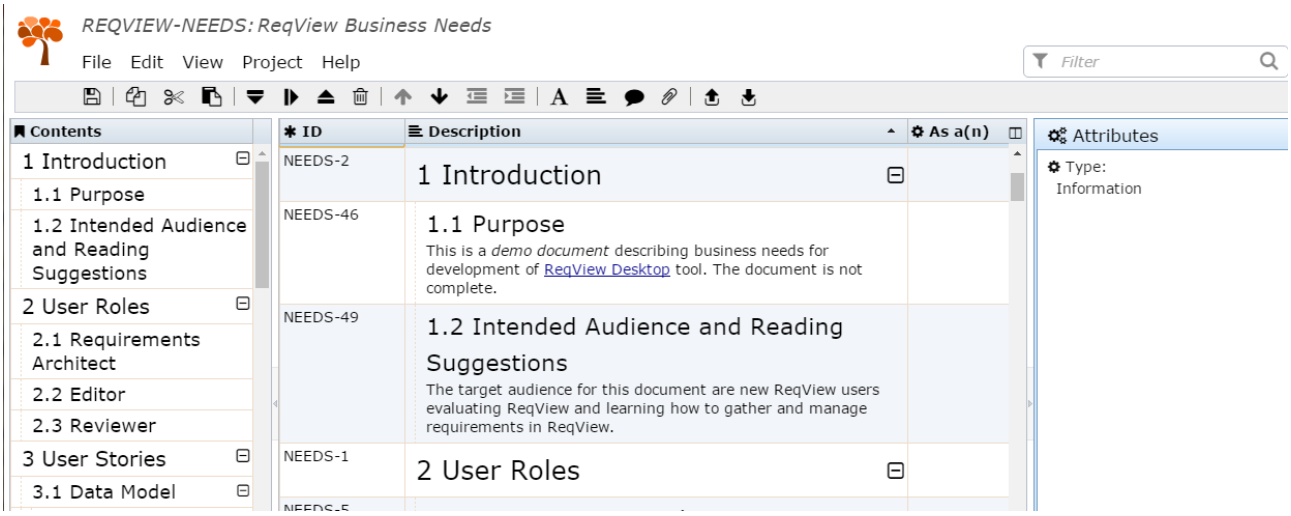
Responsible for Document: Samir Mourad

المضمون

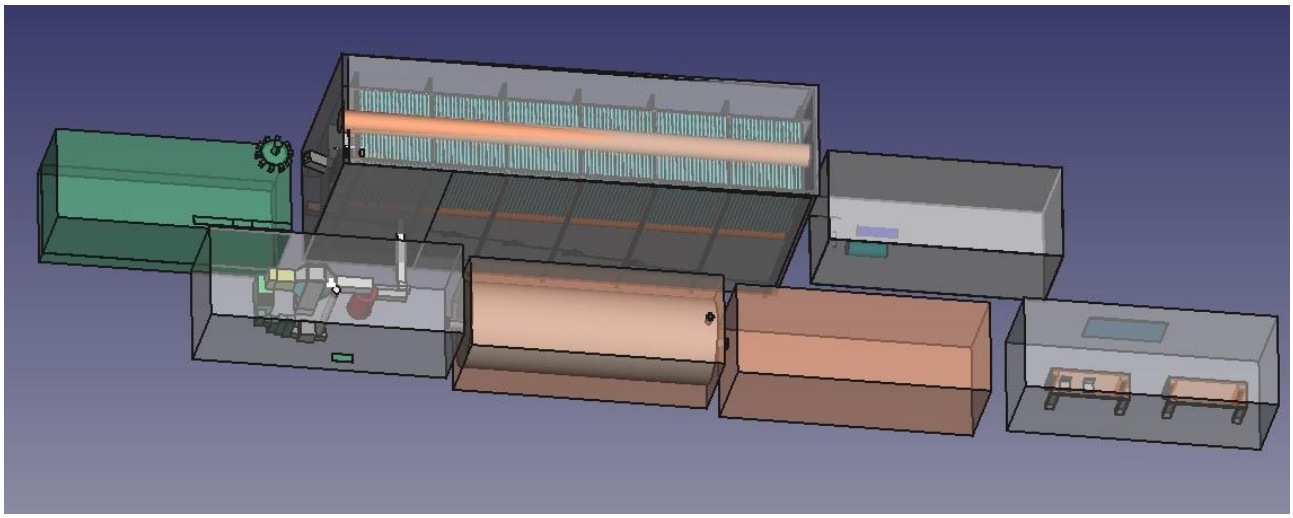
1 تمهيد

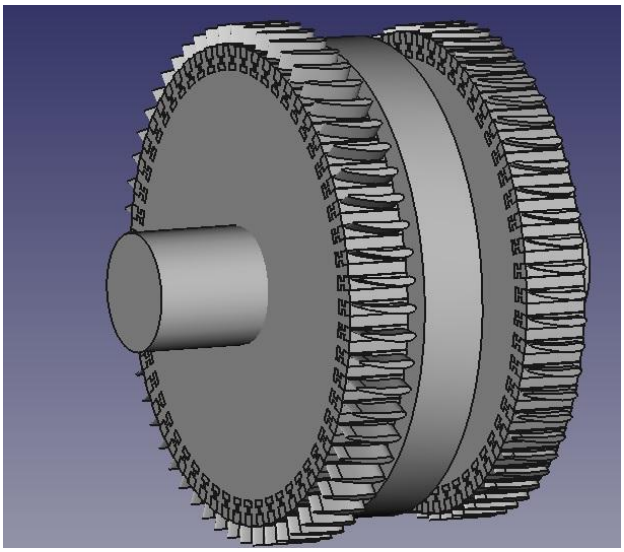
هذا المشروع يهدف الى تصنيع اول محطة صنع معظم الاجزاء من مؤسسة طاقة الشمال ومن ضمن ذلك التوربين.

2 الاحتياجات



3 تصميم المنظومة (System Design)





4.1.1 Steam system parameters for a 2MW Turbine (14 bar, 195°C)

Main
- About
- Preferences
- Glossary
- Resources
- Tutorials

Properties Calculators:
- Saturated Properties
- Steam Properties

Equipment Calculators:
- Boiler
- Heat Loss
- Flash Tank
- PRV w/ Desuperheating
- Header
- Deaerator
- Steam Turbine

Steam System Modeler

Steam Turbine Calculator watch tutorial view guide

Calculates the energy generated or steam outlet conditions for a steam turbine.

Solve for:	
Outlet Properties	
Inlet Steam	
Pressure*	200 psig
Temperature *	383 °F
Turbine Properties	
Selected Turbine Property	Power Out
Isentropic Efficiency *	30 %
Generator Efficiency *	50 %
Power Out *	2000 kW
Outlet Steam	
Pressure*	30 psig
* Required	Enter [reset]

Examples: Mouse Over

Calculation Details and Assumptions below

WARNING:

- Inlet Steam Contains Condensate
- Steam Condensing in Turbine

Inlet Steam		Mass Flow	5,502.0 klb/hr
Pressure	200.0 psig	Sp. Enthalpy	356.8 btu/lbm
Temperature	383.0 °F	Sp. Entropy	0.545 btu/lbm/R
Phase	Liquid	Energy Flow	1,963.2 MMBtu/hr

Isentropic Efficiency	30.0 %
Energy Out	13.6 MMBtu/hr
Generator Efficiency	50.0 %
Power Out	2,000.0 kW

Outlet Steam		Mass Flow	5,502.0 klb/hr
Pressure	30.0 psig	Sp. Enthalpy	354.3 btu/lbm
Temperature	274.0 °F	Sp. Entropy	0.553 btu/lbm/R
Saturated	0.12	Energy Flow	1,949.5 MMBtu/hr

required steam: about 2500 kg / hour.

Calculation details:

Step 1: Determine Inlet Properties
Using the Steam Property Calculator, properties are determined using Inlet Pressure and the selected second parameter (Temperature, Specific Enthalpy, Specific Entropy, or Quality). The Specific Enthalpy is then multiplied by the Mass Flow to get the Energy Flow:

- **Pressure** = 200.0 *psig*
- **Temperature** = 383.0 *°F*
- [Steam Property Calculator] => **Specific Enthalpy** = 356.8 *btu/lbm*

- **Inlet Energy Flow** = **Specific Enthalpy** * **Mass Flow**
  [**Inlet Energy Flow** = 1,963.2 *MMBtu/hr* = 356.8 *btu/lbm* * 5,502.0 *klb/hr*]

Step 2: Calculate Ideal Outlet Properties (Inlet Entropy equals Outlet Entropy)

- **Pressure** = 30.0 *psig*
- **Specific Entropy** = 0.545 *btu/lbm/R*
- [Steam Property Calculator] => **Specific Enthalpy** = 348.5 *btu/lbm*

Step 3: If solve for 'Isentropic Efficiency', Determine Outlet Properties
Using the outlet specific enthalpy, calculate the isentropic efficiency:

- **Isentropic Efficiency** = (**Inlet Specific Enthalpy** - **Outlet Specific Enthalpy**) / (**Inlet Specific Enthalpy** - **IDEAL Outlet Specific Enthalpy**)

Step 3: If solve for 'Outlet Properties', Determine Outlet Specific Enthalpy

1. **Isentropic Efficiency** = (**Inlet Specific Enthalpy** - **Outlet Specific Enthalpy**) / (**Inlet Specific Enthalpy** - **IDEAL Outlet Specific Enthalpy**)
2. **Isentropic Efficiency** * (**Inlet Specific Enthalpy** - **IDEAL Outlet Specific Enthalpy**) = (**Inlet Specific Enthalpy** - **Outlet Specific Enthalpy**)
3. **Outlet Specific Enthalpy** = **Inlet Specific Enthalpy** - **Isentropic Efficiency** * (**Inlet Specific Enthalpy** - **IDEAL Outlet Specific Enthalpy**)
   [**Outlet Specific Enthalpy** = 354.3 *btu/lbm* = 356.8 *btu/lbm* - 30.00 *%* * (356.8 *btu/lbm* - 348.5 *btu/lbm*)]

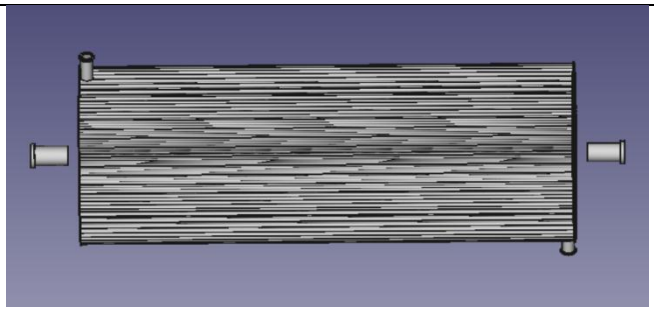
Using the outlet specific enthalpy, calculate the outlet properties:

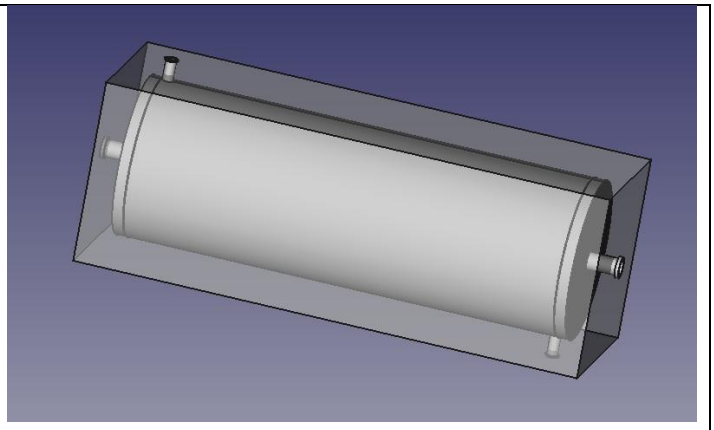
- **Pressure** = 30.0 *psig*
- **Specific Enthalpy** = 354.3 *btu/lbm*
- [Steam Property Calculator] => **Temperature** = 274.0 *°F*

Step 4: Calculate Steam Turbine Energy Out and Generation (Power Out)

- **Energy Out** = (**Inlet Specific Enthalpy** - **Outlet Specific Enthalpy**) * **Mass Flow**
  [**Energy Out** = 13.6 *MMBtu/hr* = (356.8 *btu/lbm* - 354.3 *btu/lbm*) * 5,502.0 *klb/hr*]

- **Power Out** = **Energy Out** * **Generator Efficiency**
  [**Power Out** = 2,000.0 *kW* = 13.6 *MMBtu/hr* * 50.00 *%*]



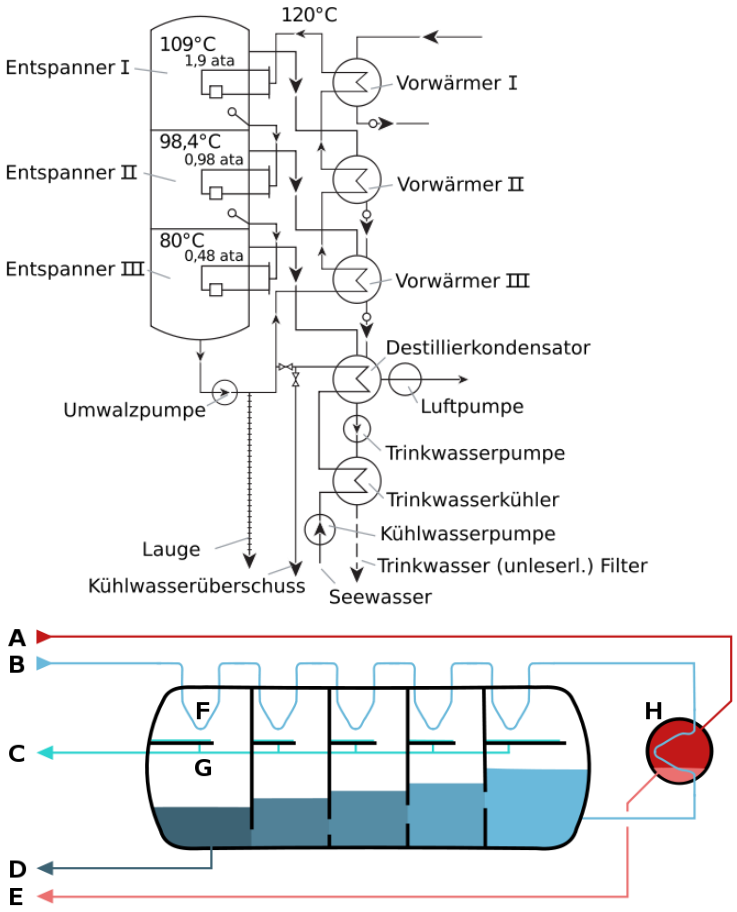


Length: 6 m, Nbs of tubes 530

Heat transfer between steam and water

6 Cooling of Condensor

6.1 Sea water desalting unit for condensor cooling cycle



Schematic of a multistage flash desalinator

A – steam in, B – seawater in, C – potable water out, D – waste out, E – steam out

F – heat exchange, G – condensation collection, H – brine heater

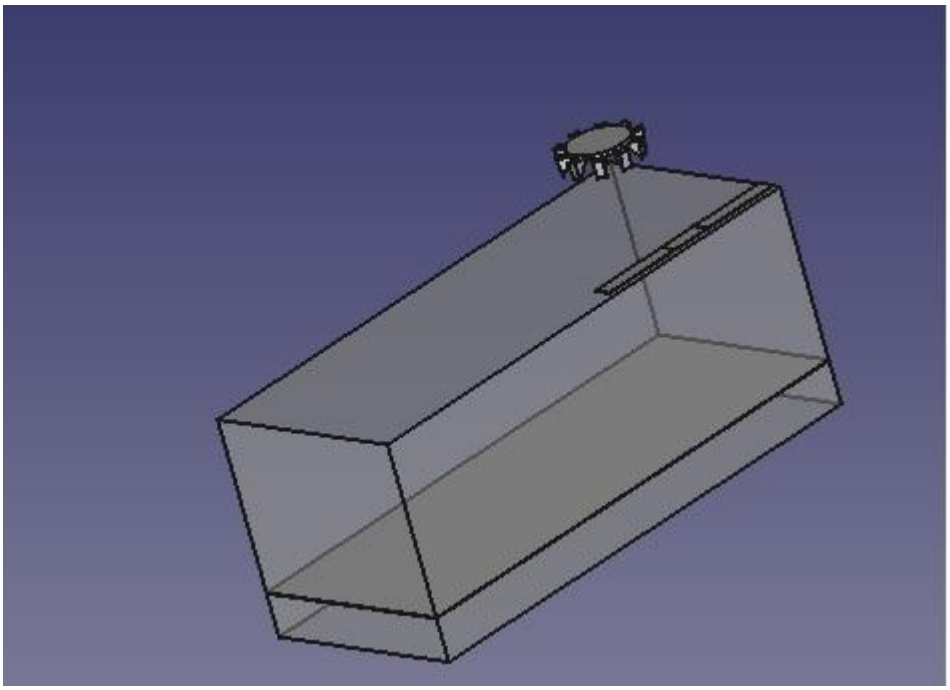
6.2 Cost for cooling (with fresh sea water cycle)

- 500 متر بعيد من البحر: 1000 متر انابيب

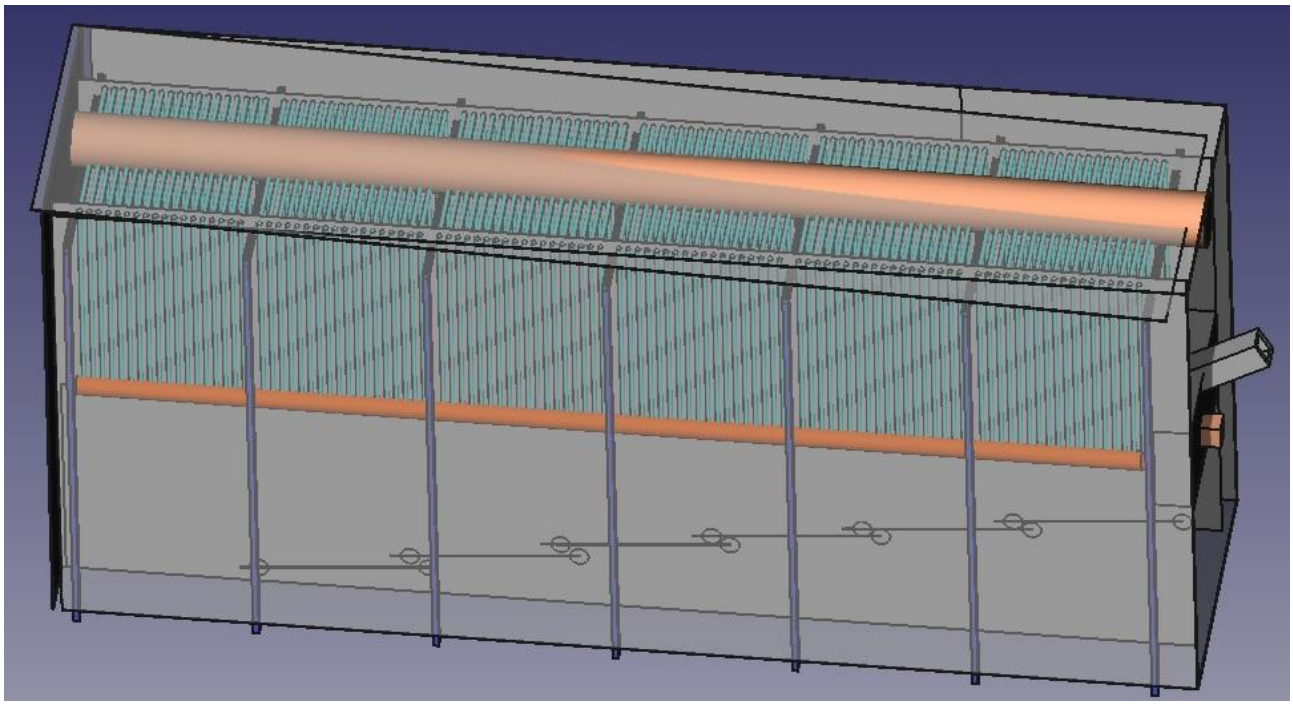
Cooling						
	Length [m]	قصتر 6 متر#	Price per pipe element	Total price		
Pipes	1000	167	$30	$5.000		
		#Pumps	Price per pump			
Pumps		2	$200	$400		
					Total cooling	
					$5.400	

7 خزان الماء (water tank)

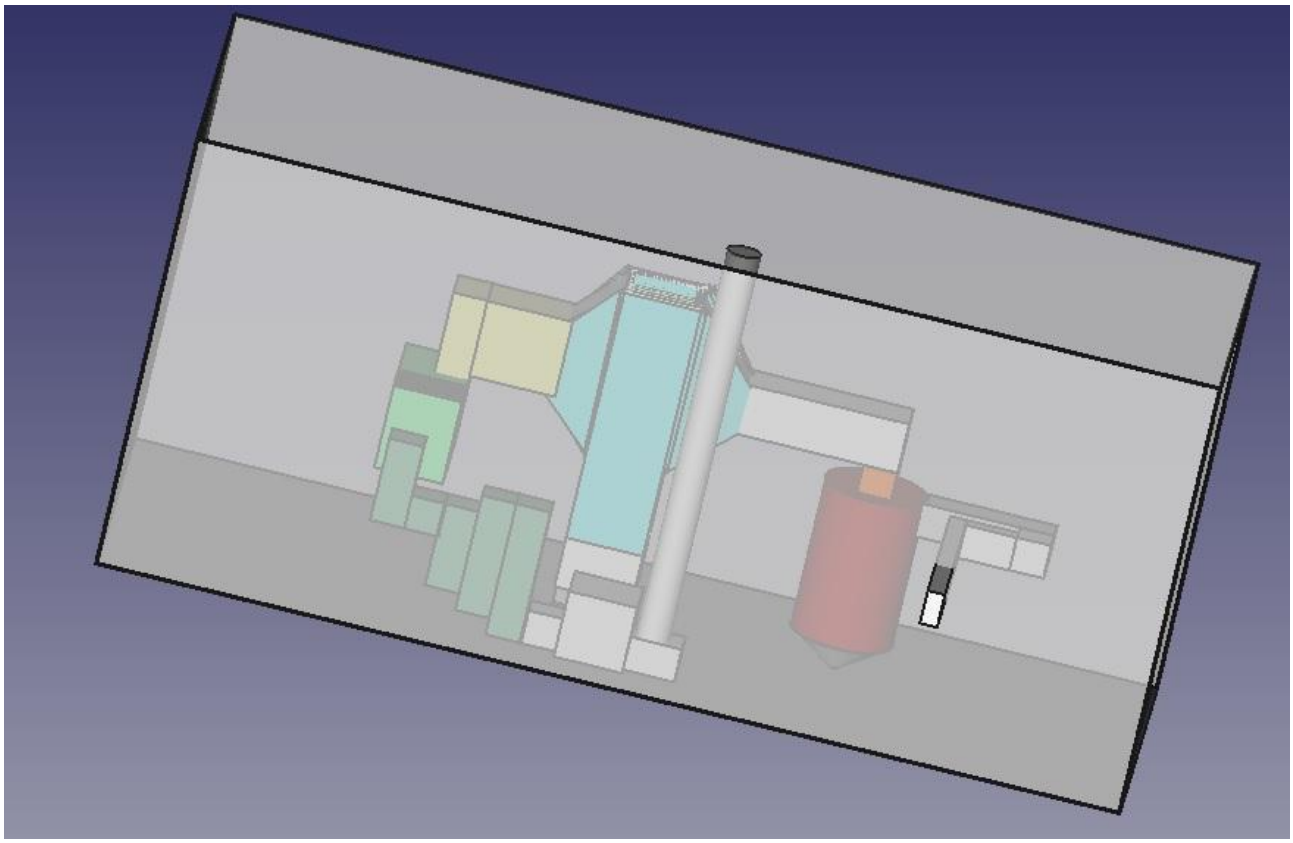
8 مدخل النفايات



9 المحرقة والمبخر



10 تنقية الدخان



انظر Master Thesis Maysaa Kamareddine, 2016

10.1 Incineration Tests[1]

10.1.1 Incineration without plastic

Figure 1:beginning of combustion

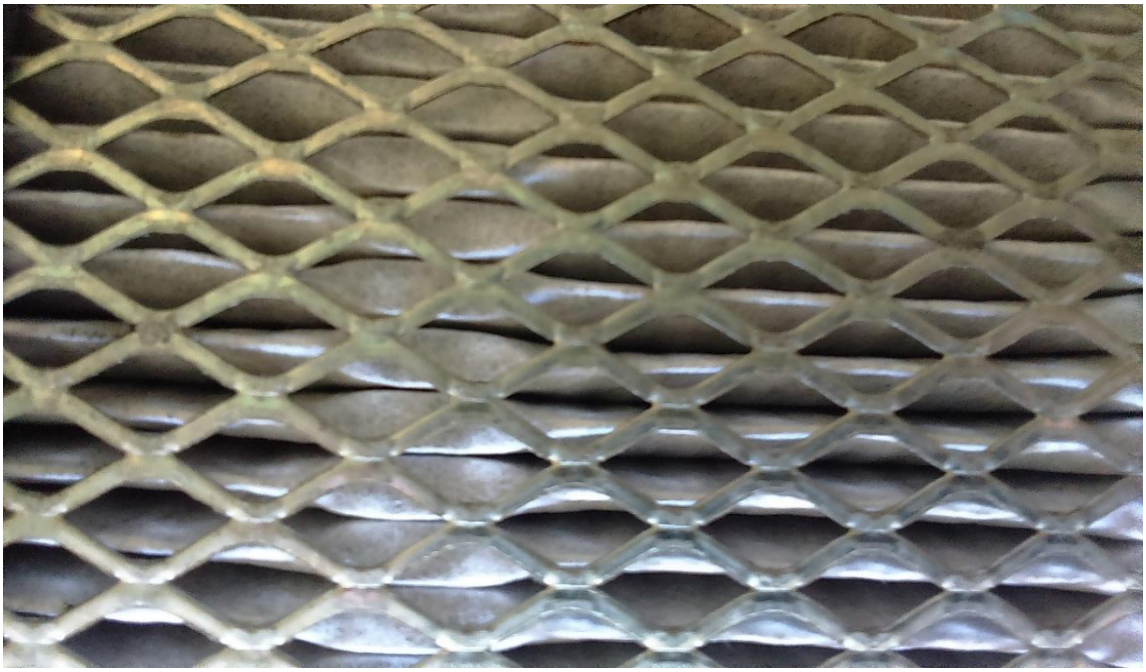


Figure 2: filter media after treatment

[1] Master Thesis Maysaa Kamareddine, 2016

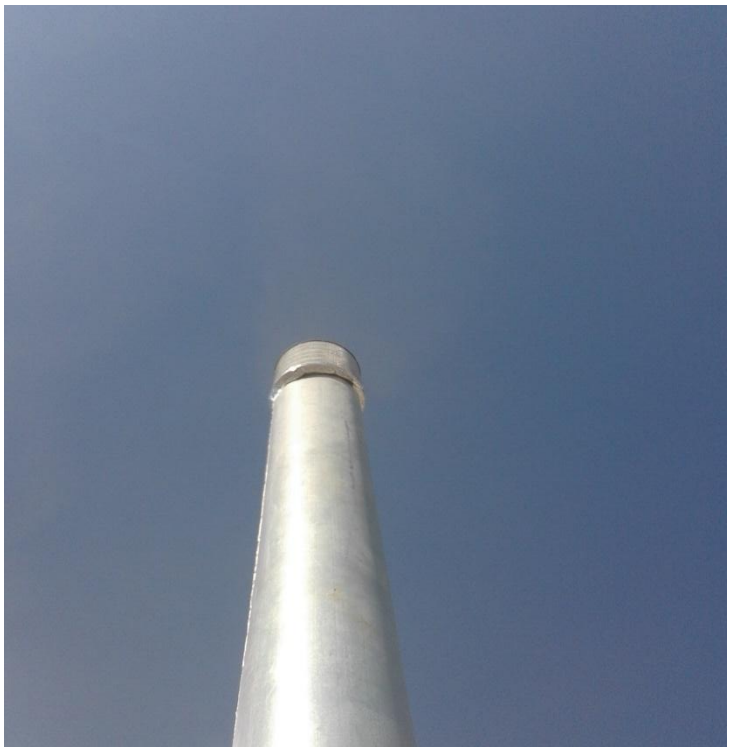


Figure 3:chimney during incineration

Calculation of emissions

V2 = V1 * (P1/P2) * (T2/T1) * (Z2/Z1)

Converting to uniform units

V1 = 314.000 Nm^3/h

P1 = 1.000 atm

T1 = 273.150 °K

T2 = 323.150 °K

P2=1.000 atm

P1, T1 normal conditions

P2, T2 specification for exhaust

Z1=1 (ideal), Z2=1.01(at 1 atm): Compressibility Factor

Calculation for V2

V2 = 314.000*(1.000/1.000) *(323.150/273.150)*(1.100/1.100)

V2 = 375 m^3/h

Or mass of filter before treatment =1300 g

mass after treatment =1364

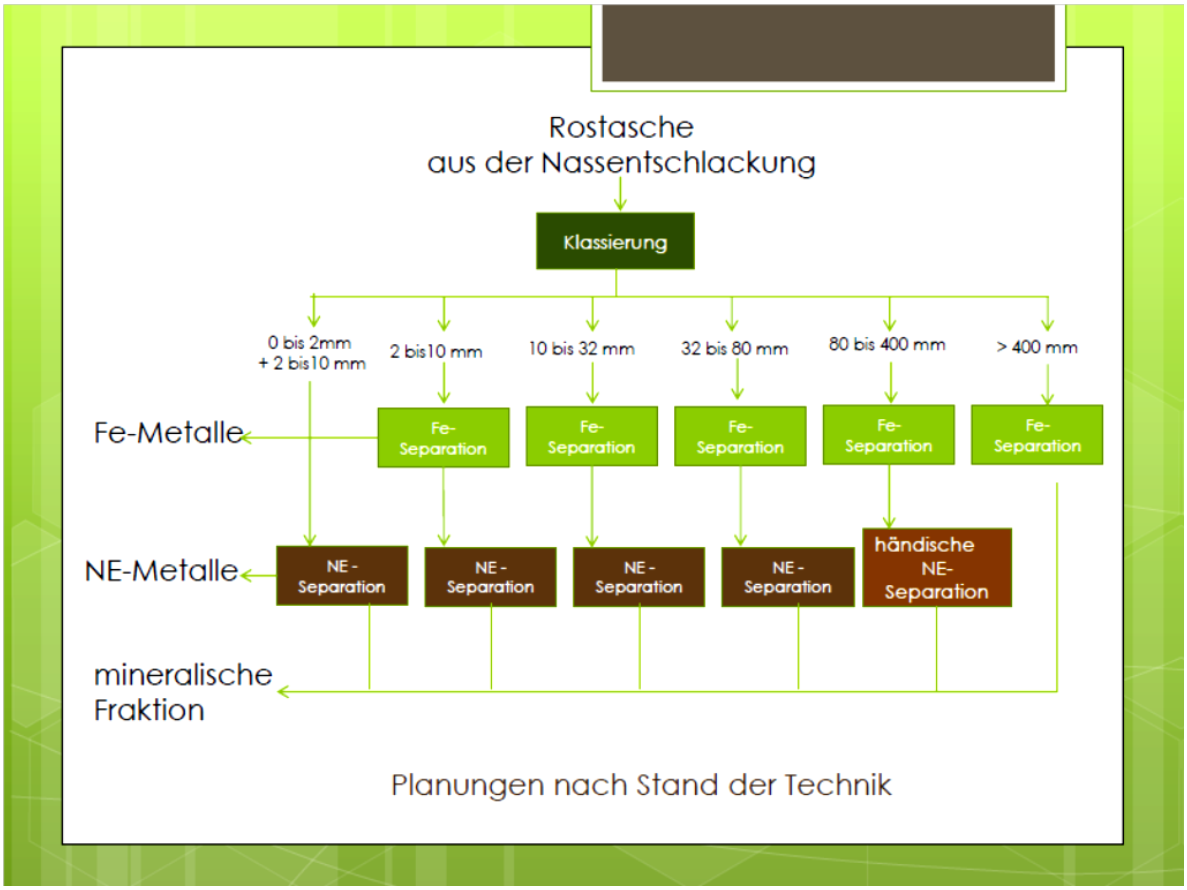
the total mass of particulate =1364-1300=64 g

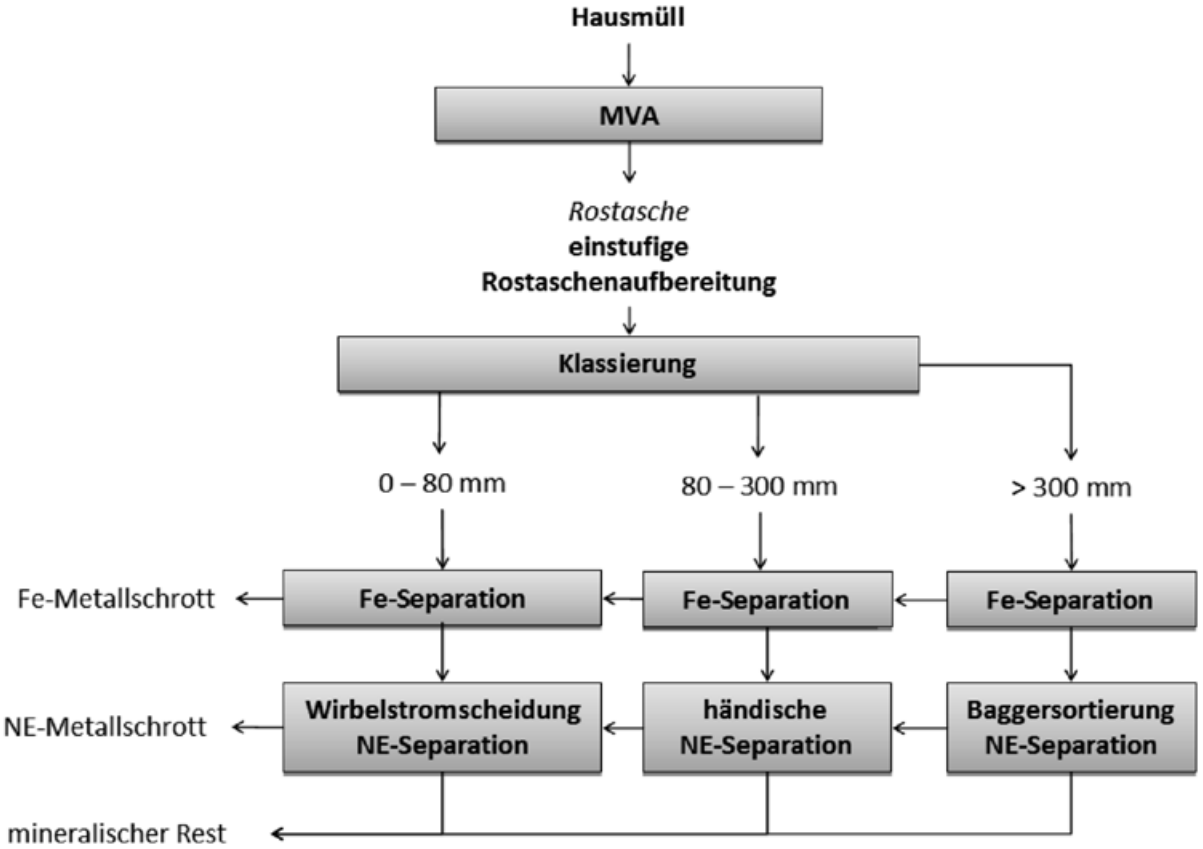
375 m^3/h correspond to 64 g

Thus 170 mg / m^3 <200 mg/ m^3 confirm to Lebanese standard (annex D) positive results

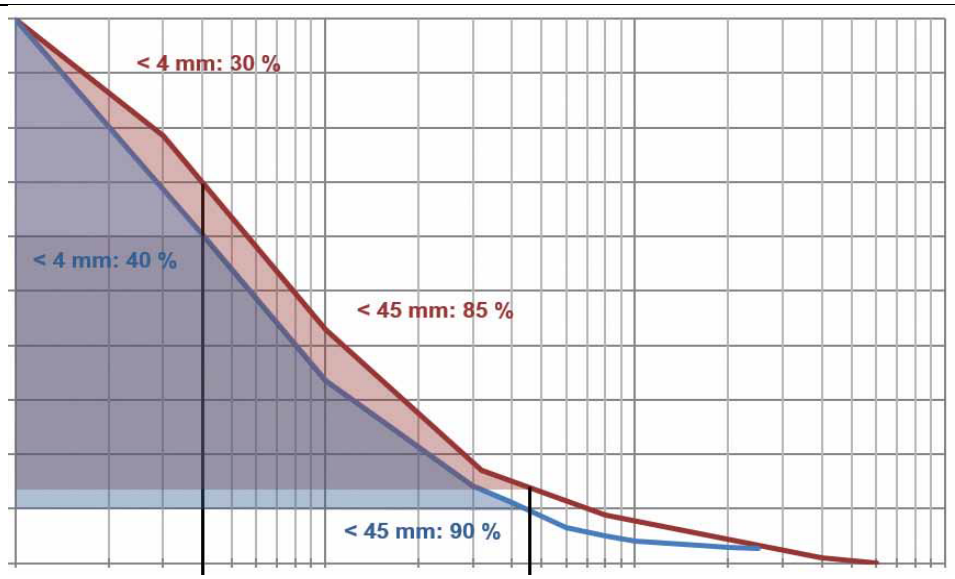
11 معالجة الرماد (Aufbereitung von Rostasche) بعد حرق النفايات المنزلية

11.1 نظرة عامة





توزيع حجم الجسيمات من الرماد: ما بين 0 و 45 ملمتر تشكل 90% من الرماد



Schadstoffe (Alwast)	
Parameter	**Wertebereich**
Arsen	3 bis 15 mg/kg
Blei	1.000 bis 3.500 mg/kg
Cadium	2 bis 20 mg/kg
Chrom ges.	200 bis 1.000 mg/kg
Kupfer	1.000 bis 10.000 mg/kg
Nickel	100 bis 500 mg/kg
Wertstoffe	
Parameter	**Verwertbare Anteile**
Fe-Metall	8 %
NE-Metall	2 %
VA-Metall	1 %

مثال

Die Metalle sind ferner in die Fraktionen Eisenmetalle (Fe) und Nichteisenmetalle (NE) zu unterteilen.

drei Hauptbestandteile der Rostasche

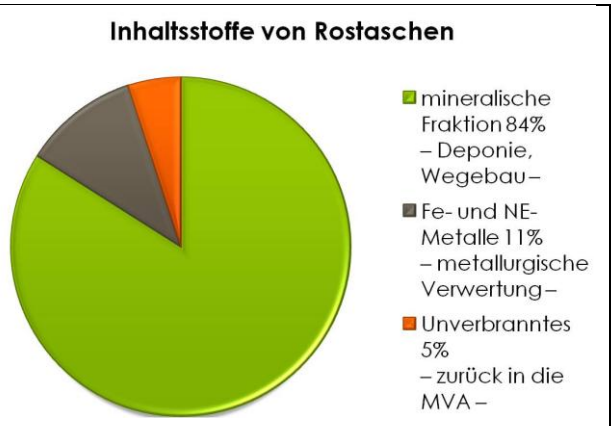
المكونات الرئيسية الثلاثة للرماد

84% معادن (minerals)

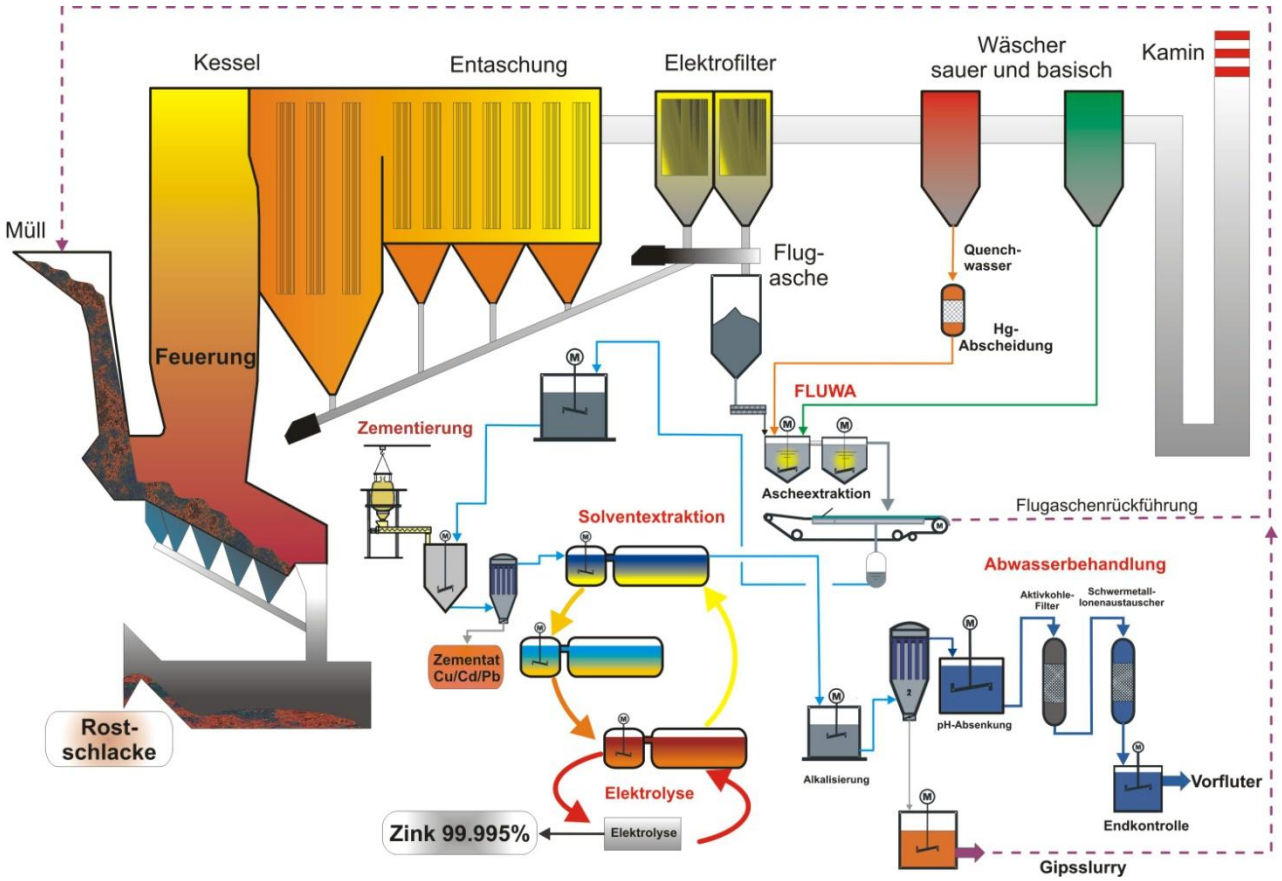
(وما لم تتغيره عملية الحرق مثل بطون ، حجر،

Im Hinblick auf eine spätere verfahrenstechnische Aufbereitung ist Rostasche in drei Hauptbestandteile aufzuteilen. Hierbei können aufgrund der Inhomogenität der Inputmaterialien nur Schwankungsbreiten angegeben werden. Das Bild 2 zeigt die beispielhafte Zusammensetzung aus uns vorliegenden Materialansprachen.

VA-Metall = Rostfreier Stahl (stainless steel)

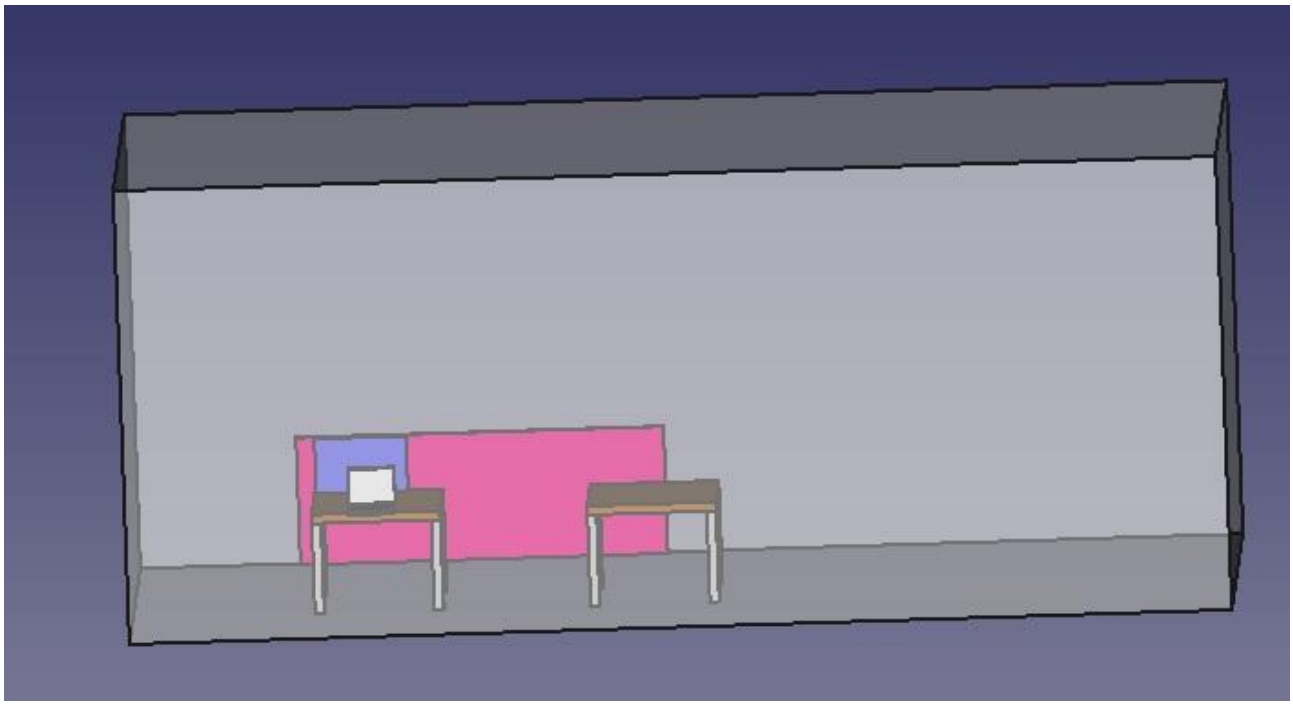
ارميد، ...) 10% حديد (و الومينيوم، نحاس) Unter den Metallen sind eisenhaltiger Schrott, Aluminium,) (Kupfer und Messing vorhanden 5% لم يحرق ولكن قابل للحرق و يعاد الى المحرقة (مثل خشب، ورق، ثياب، ...)	

FLUREC/FLUWA *11.2*

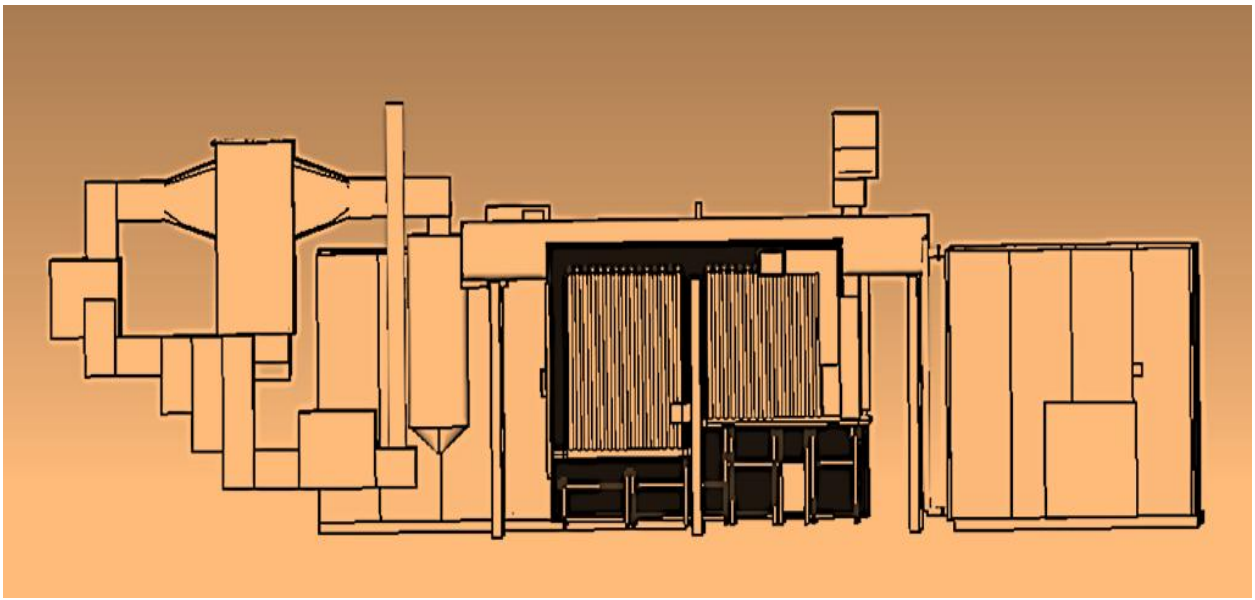


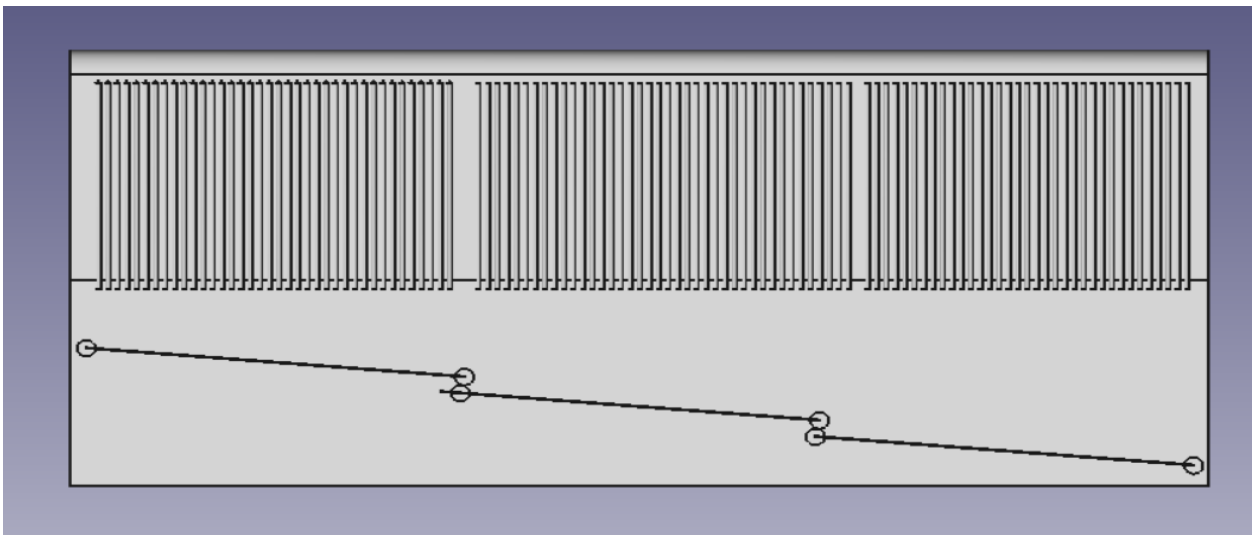
chemical ash recycling

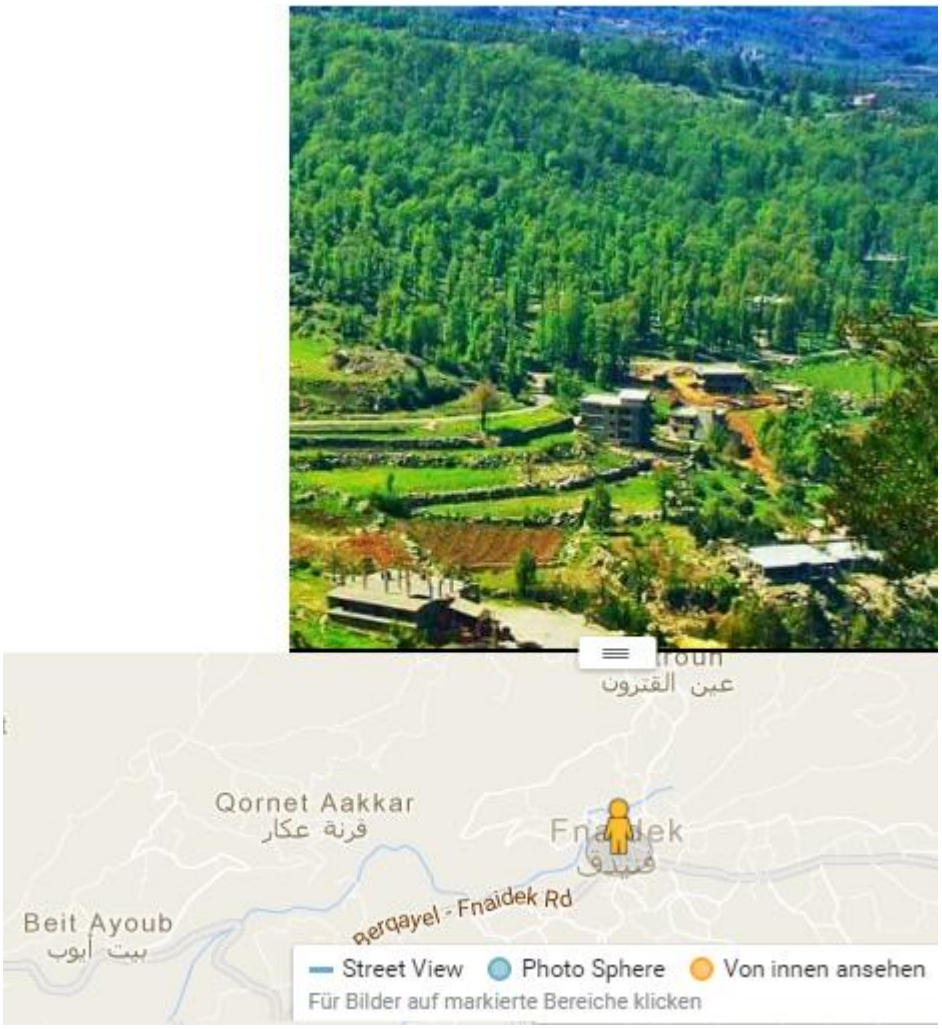
12 غرفة التحكم



2 MW for Mishmish/Akkar *13.1*



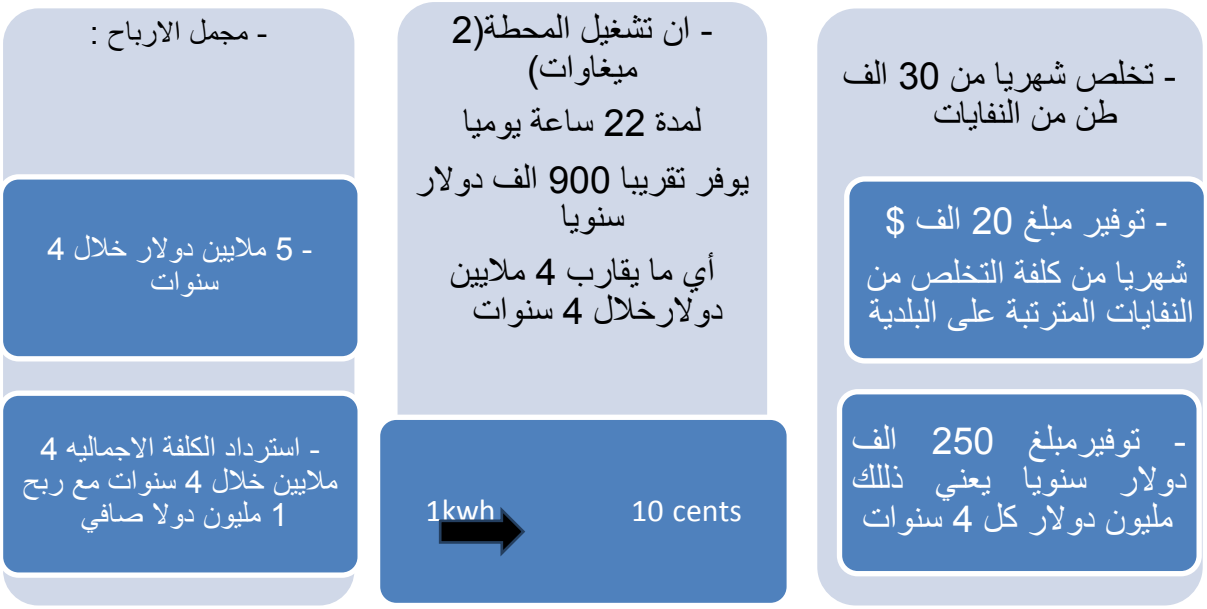




نحتاج من البلدية مساحة ارض تساوي 500متر مربع

Installation cost (materials + project management): 2 MW turbine and generator,pipes,pumps,filters exchanger, condenser about 3 million $

الايجابيات



Supplier 14

14.1 تصنيع قطع (CNC...)

Company	Phone number	Description	Address	E-mail web site
CNC LAB	06 412 895 03 476 916	Manufacture 3D design in plastic & open source hardware	Tripoli,Lebanon Bahsas,Behind Haykalieh Hospital, Harba Bld.	www.cnclab.com info@cnclablb.com
Hasan Al Baba	03 828 256	Manufacture and casting	Tripoli, Lebanon Mina, Industry and Commerce street	
HI-Tech fabrication Fawaz Abdel Hadi	06 442 787 70 751 522	Precision mechanical parts manufacturing brass & steel marking heads maker	Tripoli, Lebanon Mahjar suhi P.O. Box 1274	www.hitechfabrication.com info@hitechfabrication.com sirfawaz@yahoo.com
Hannuf mechanical 'Corporation for casting and art construction	06 387 723 03 717 107	Manufacture and casting	Tripoli, Lebanon Al Badawi	
GPS Steel	03 196 225	Uses electric discharge machining process to shape any metal material rapidly by using desired modeled electrodes	Beirut, Lebanon Burj Hammoud	Gps.steel.co@gmail.com
Riyako factory	79 118 779	3D CNC machine, manufacture cupboard for cars	Tripoli, Lebanon Badawi, behind Al Ridani bakery	

14.2 صب

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