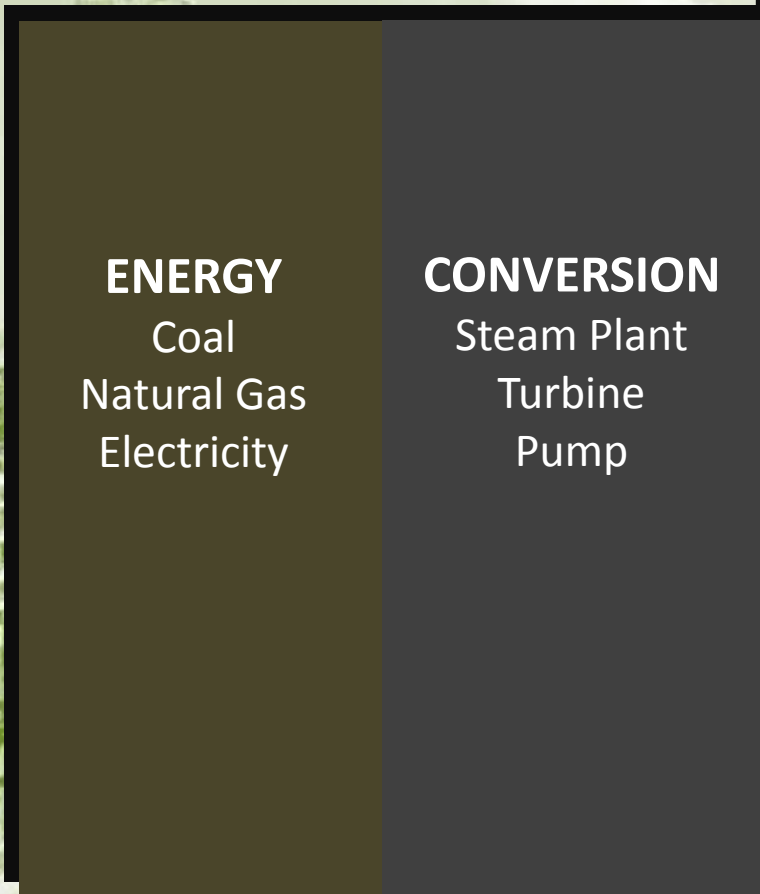




WASTE ENERGY TO POWER
SOLUTIONS

Global Opportunity
Focused Opportunity
GHG Opportunities
Genalta – Who are we
Technical Overview

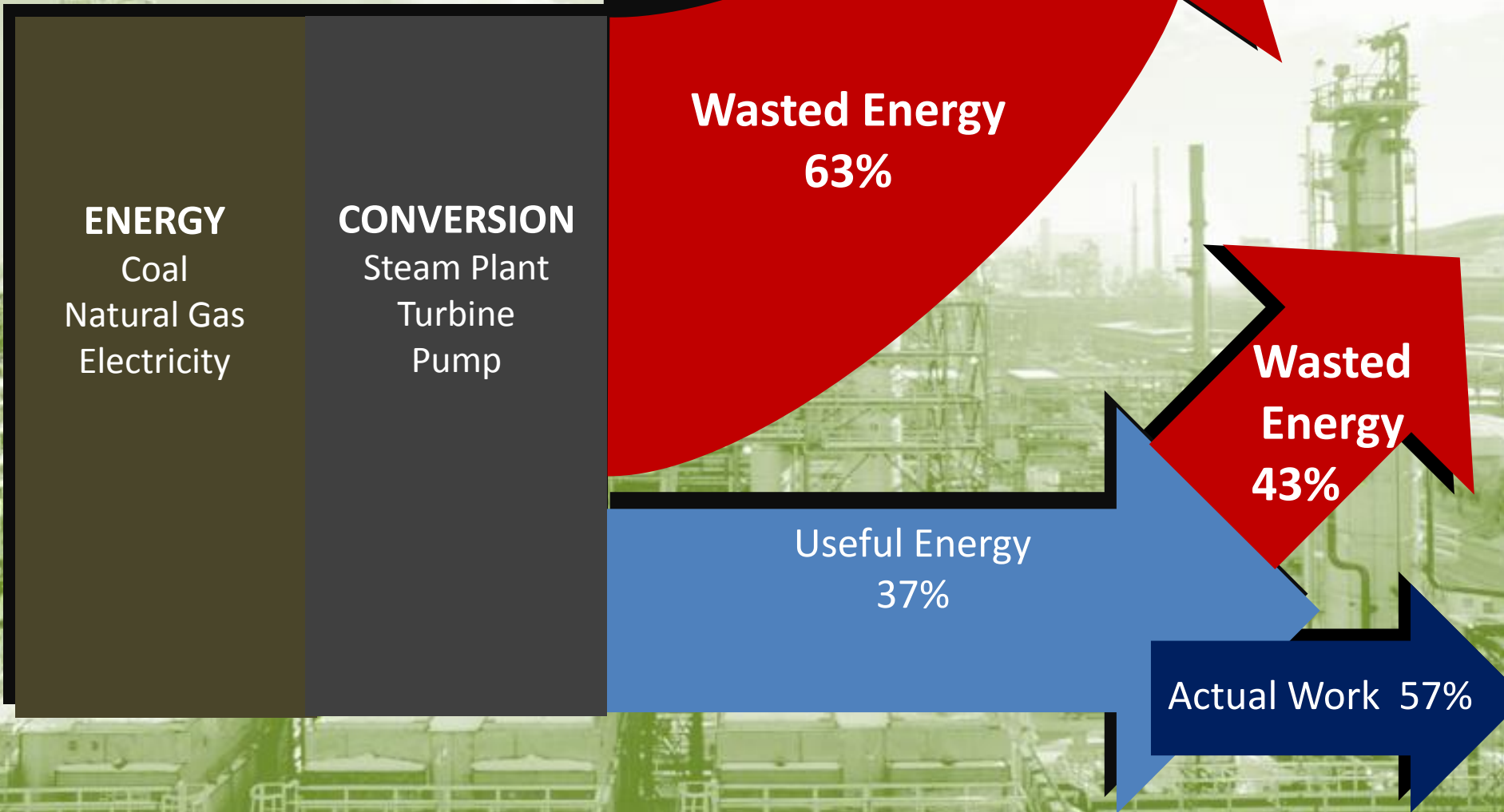
GLOBAL OPPORTUNITY



Wasted Energy
63%

Useful Energy
37%

GLOBAL OPPORTUNITY



ENERGY
Coal
Natural Gas
Electricity

CONVERSION
Steam Plant
Turbine
Pump

Wasted Energy
63%

Useful Energy
37%

Wasted Energy
43%

Actual Work 57%

OPPORTUNITY:

Generate **GREEN, BASELOAD**
POWER from waste energy



Genalta Power

GREEN HOUSE GASES

SOURCE

AMOUNT OF CO₂

Coal Fired Power Production

1.02 MT/MWh

Oil Fired Power Production

0.76 MT/MWh

Gas Fired Power Production

0.52 MT/MWh

Incineration

1.40 MT/MWh

Grid Interconnect

Control Systems

Operating Parameters

Component Selection

SCADA

Waste Energy Source

Site Specific Requirements

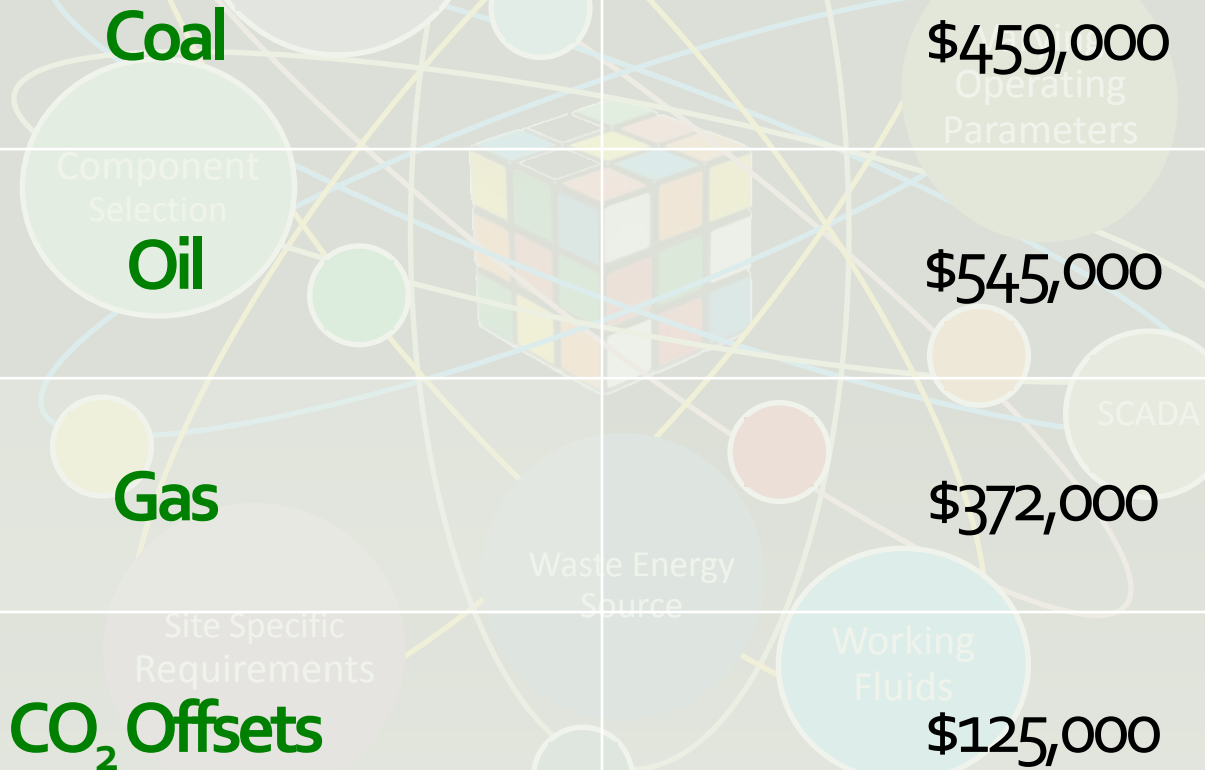
Working Fluids



SAVINGS

SOURCE

ANNUAL SAVINGS/MW



**Renewable
Energy**

Power
Developer

Ability to Deploy
necessary

Resources



Extensively
invested in

**Research &
Technology**

Long Term

Relationship

Research &
Development

System
Optimization

Engineered
SOLUTION

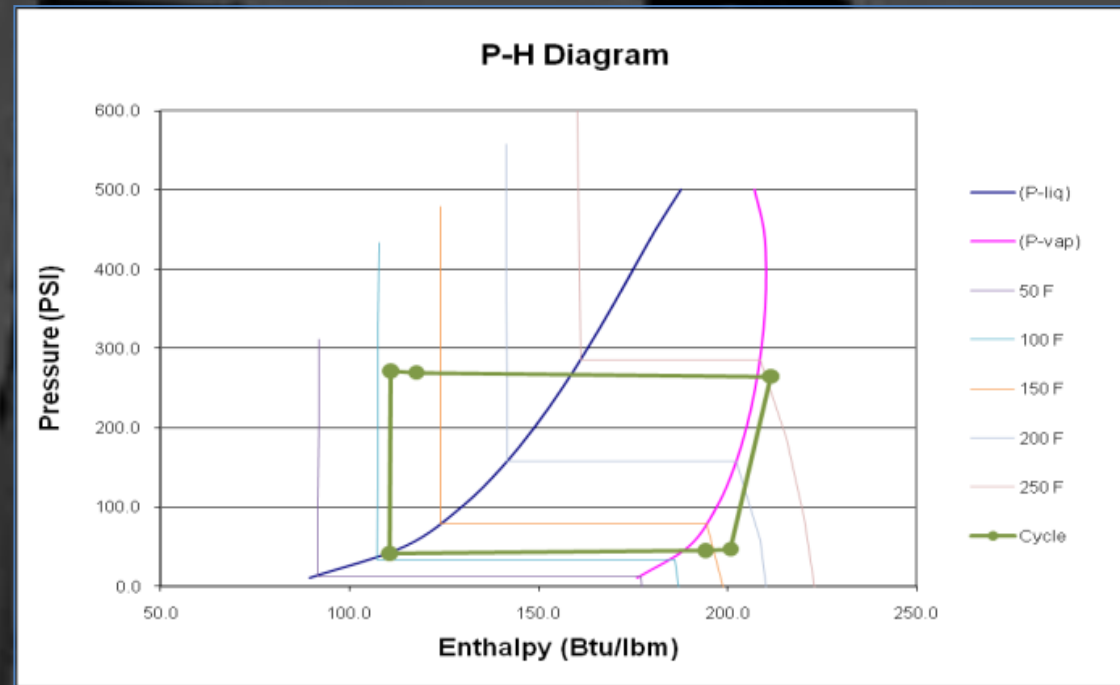
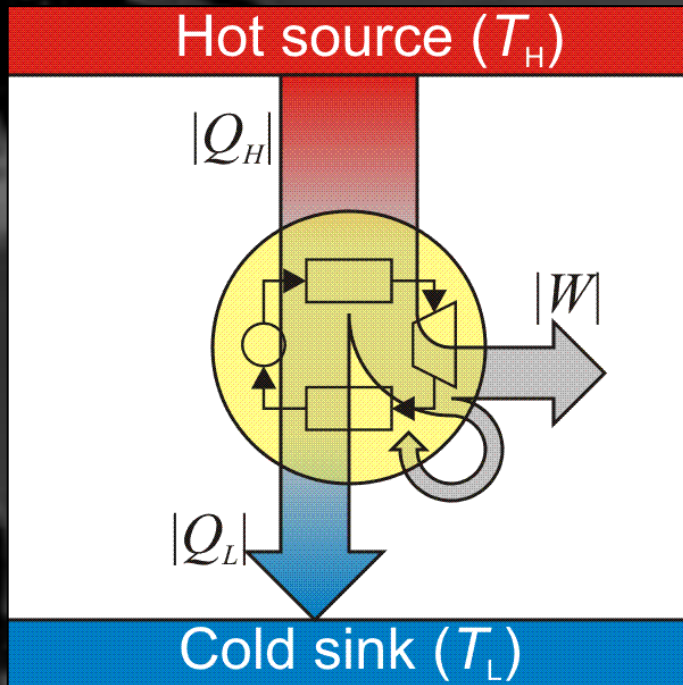
Project
Execution



Genalta Power

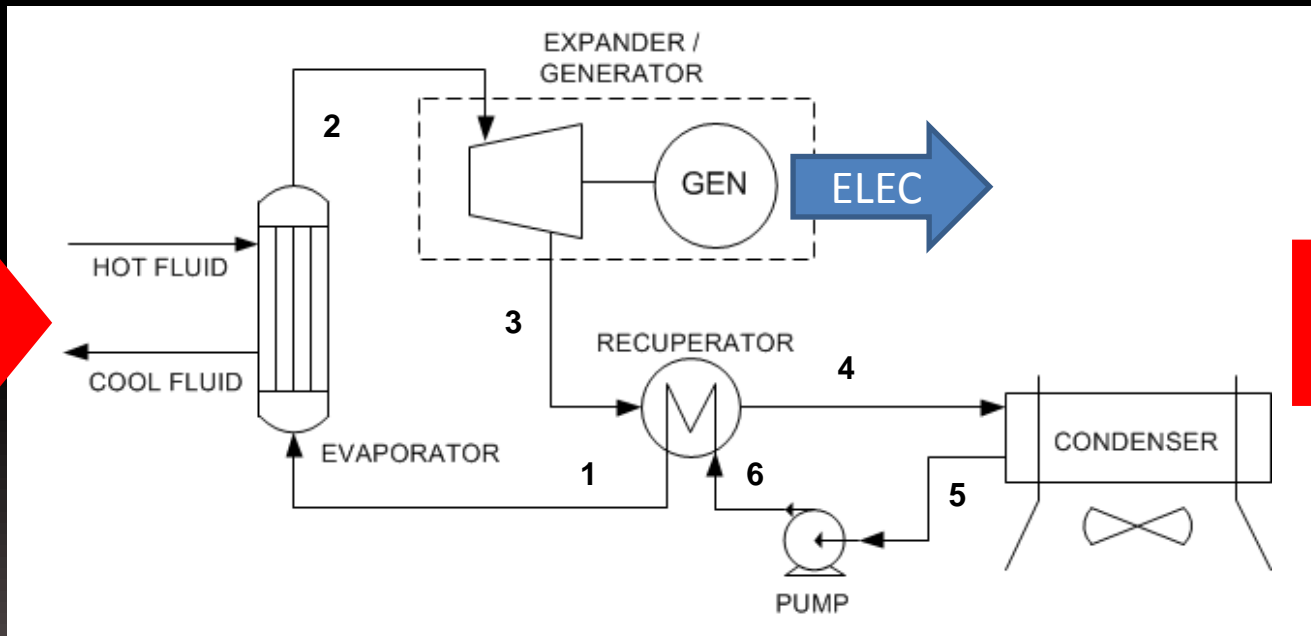
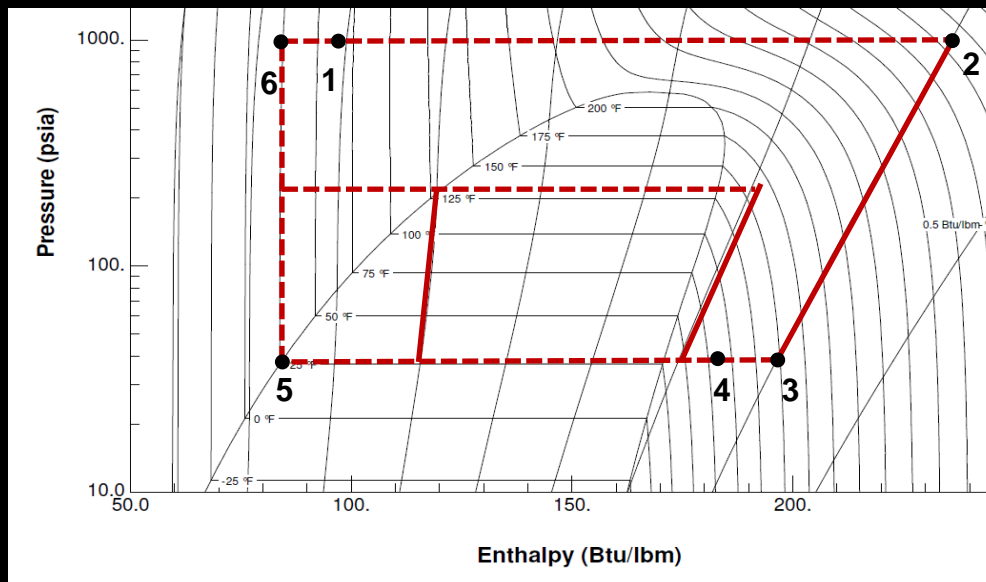
Waste Heat to Power

ORGANIC RANKINE CYCLE

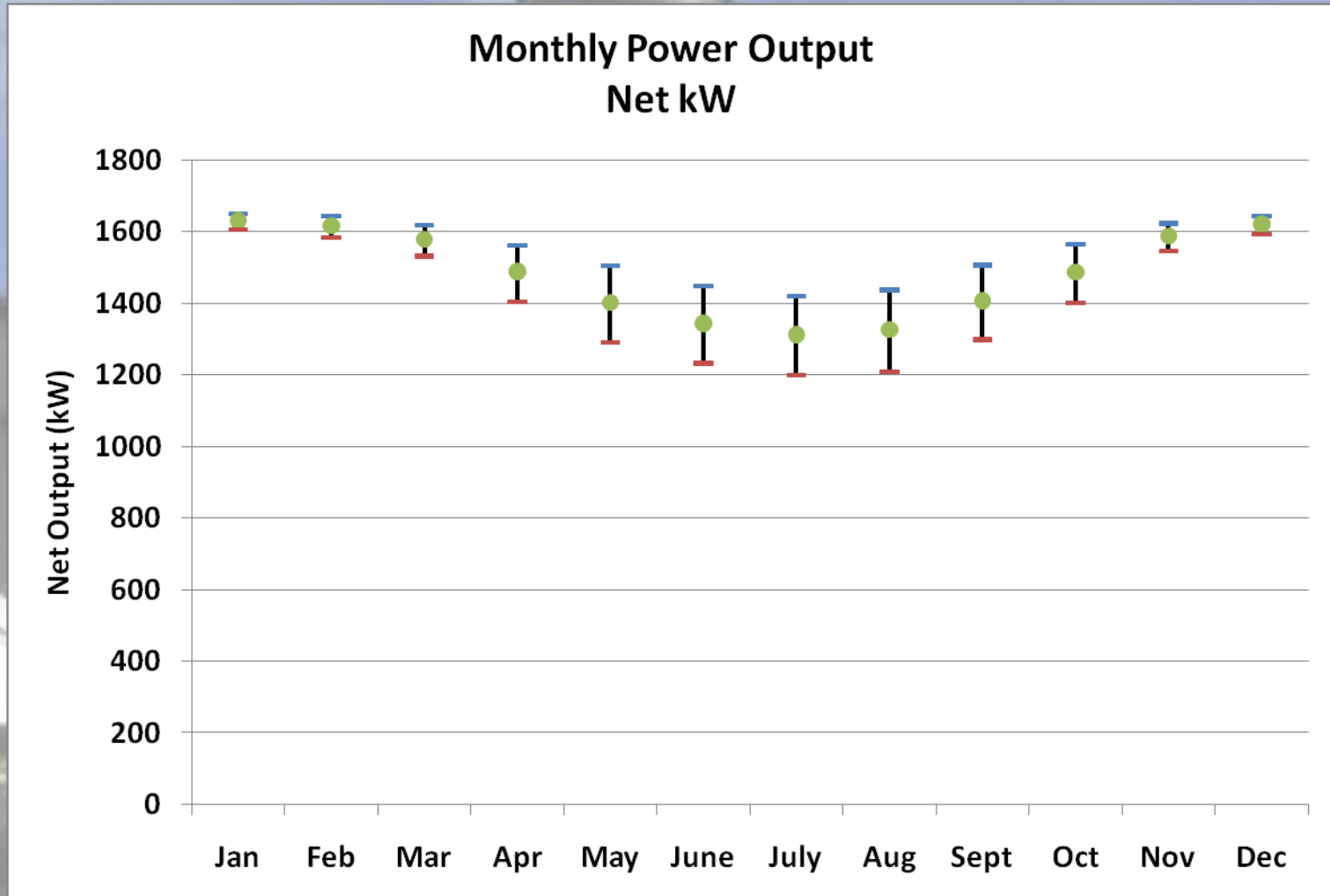


Opportunities:

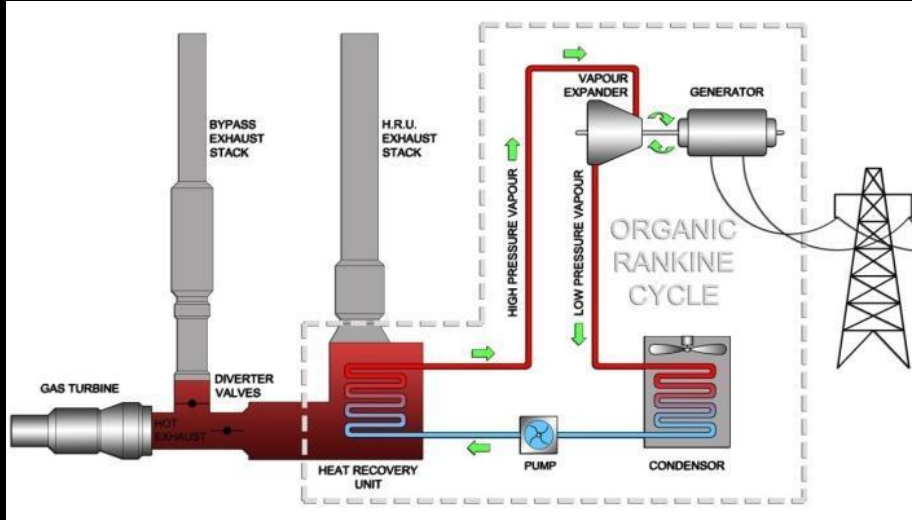
Hot Exhaust
Steam Condensers
Hot Liquids



SITE EXAMPLE



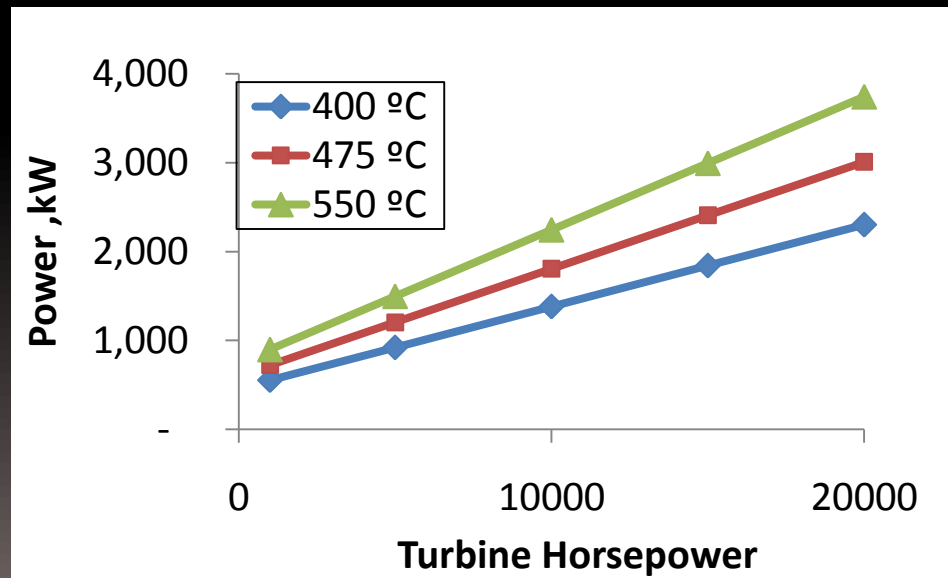
EXHAUST HEAT



Minimum 200°C (400°F)

RULE OF THUMB

$$\text{kW}_{\text{net}} = \text{Shaft HP} \times 20\%$$



HOT LIQUIDS

Site Selection

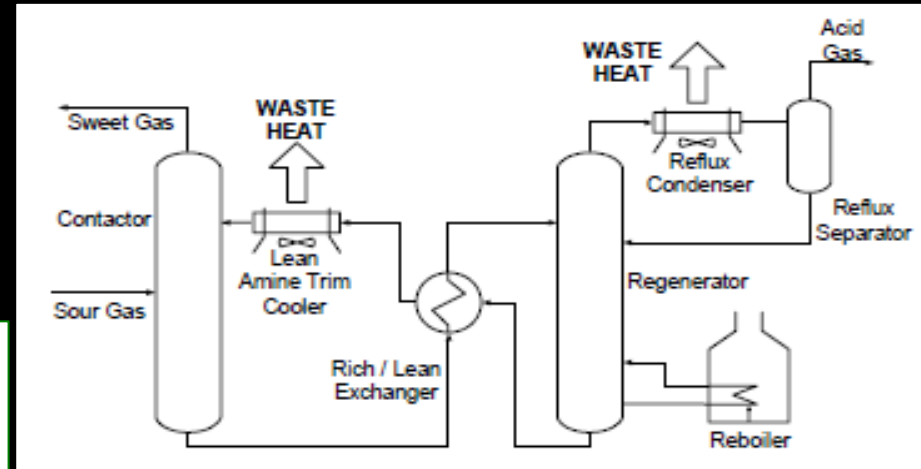
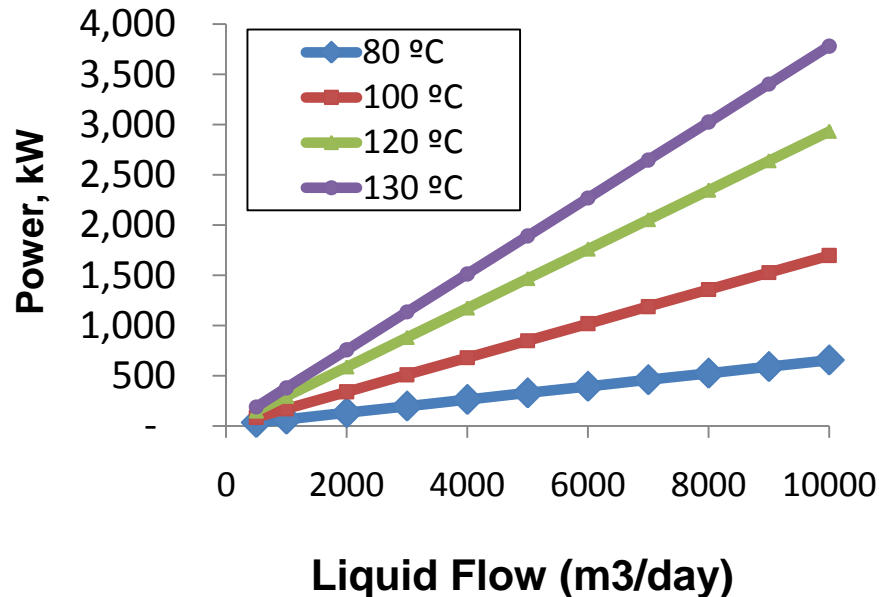
Temp (Min): 80°C

176°F

Flow (Min): 100 m³/hr

500GPM

Reduce cooling fan load



RULE OF THUMB

100°C

$$\text{kW}_{\text{net}} = 3.6 \times (\text{m}^3/\text{hr})$$

STEAM CONDENSERS

Heat of Condensation

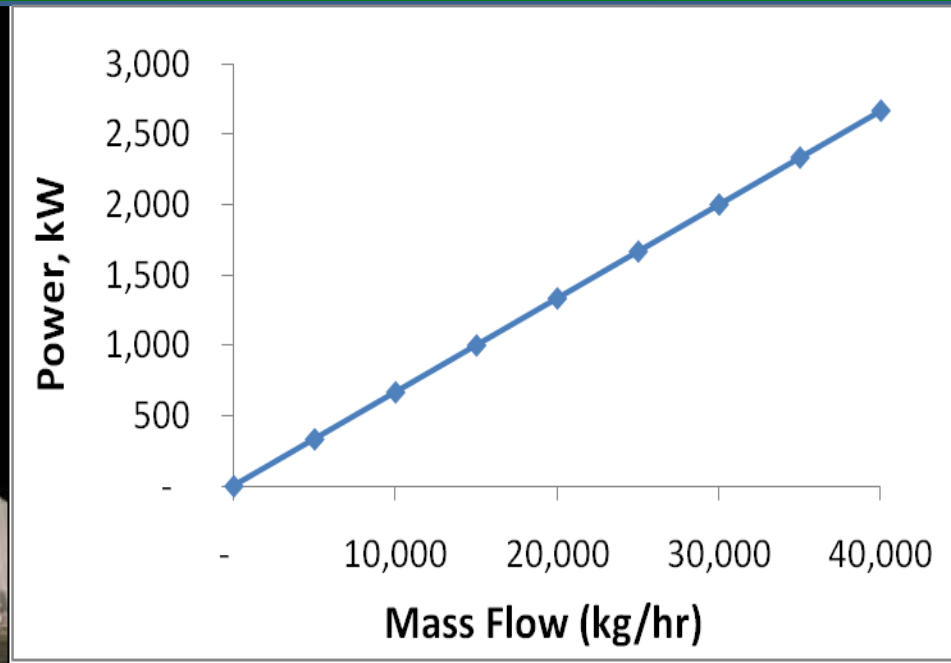
Reduce cooling fan load

Site Selection:

Pressure: > atmospheric

RULE OF THUMB

$$\text{kW}_{\text{net}} = \text{Flow (kg/hr)} \div 15$$

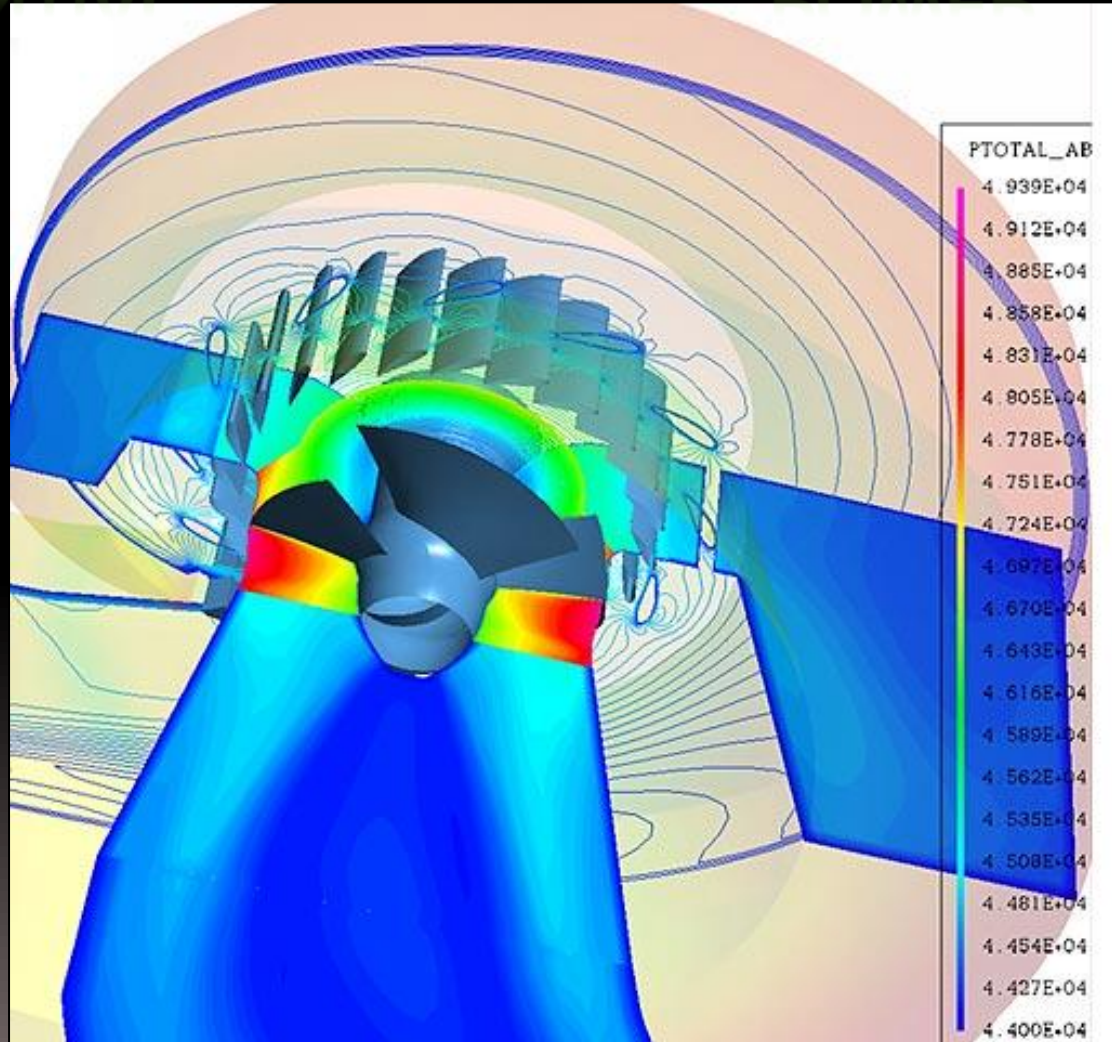


Waste Pressure to Power

**PRESSURE
DIFFERENTIAL**

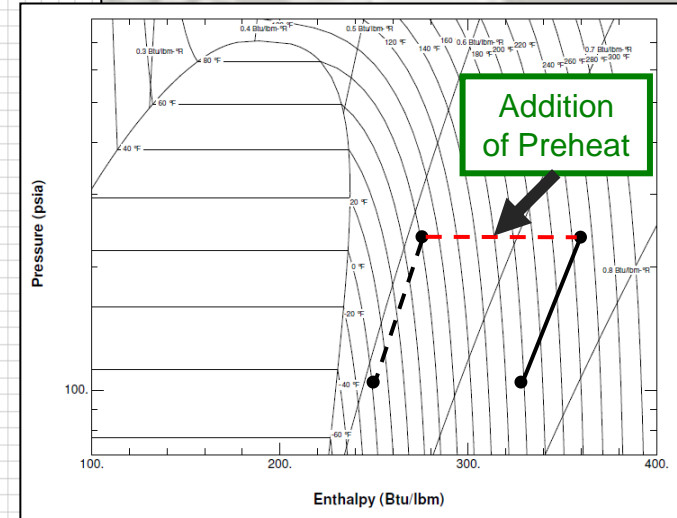
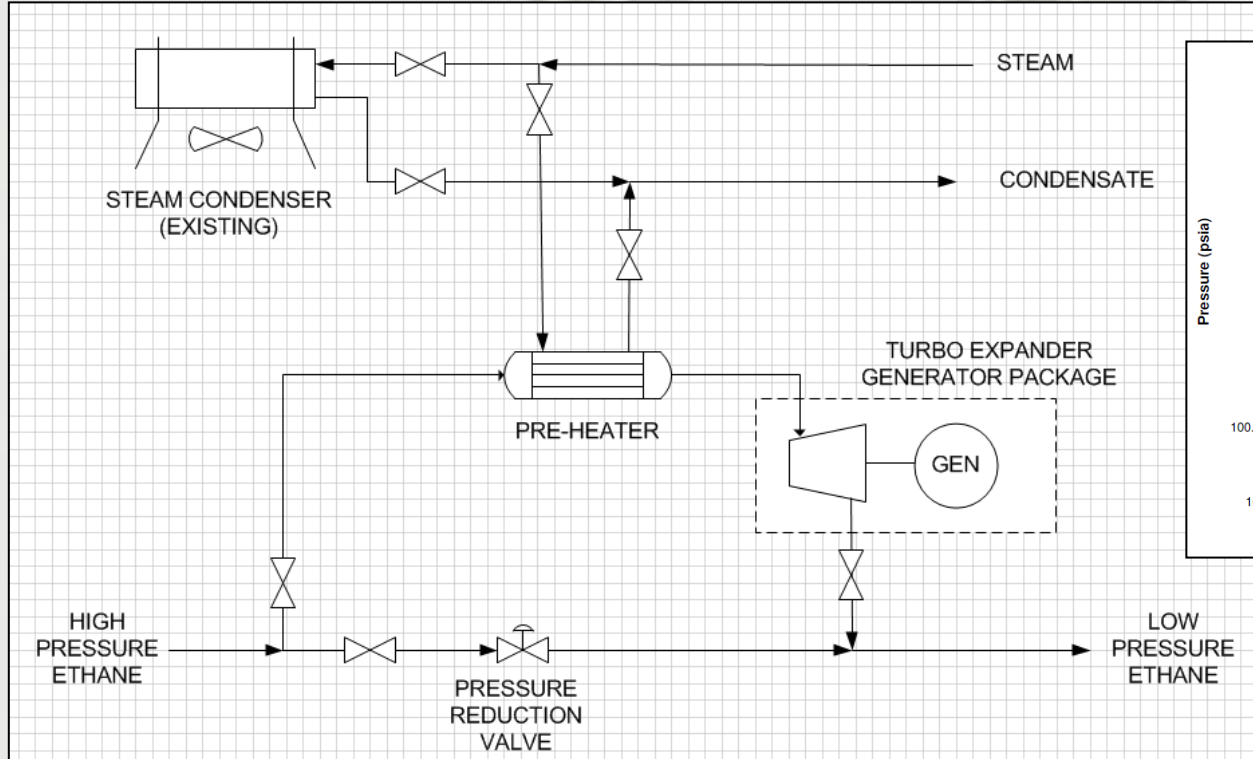


**ROTATIONAL/MECHANICAL
POWER**



SITE EXAMPLE

Ethane Pressure Letdown



GAS PRESSURE LETDOWN

Turbo Expander Technology

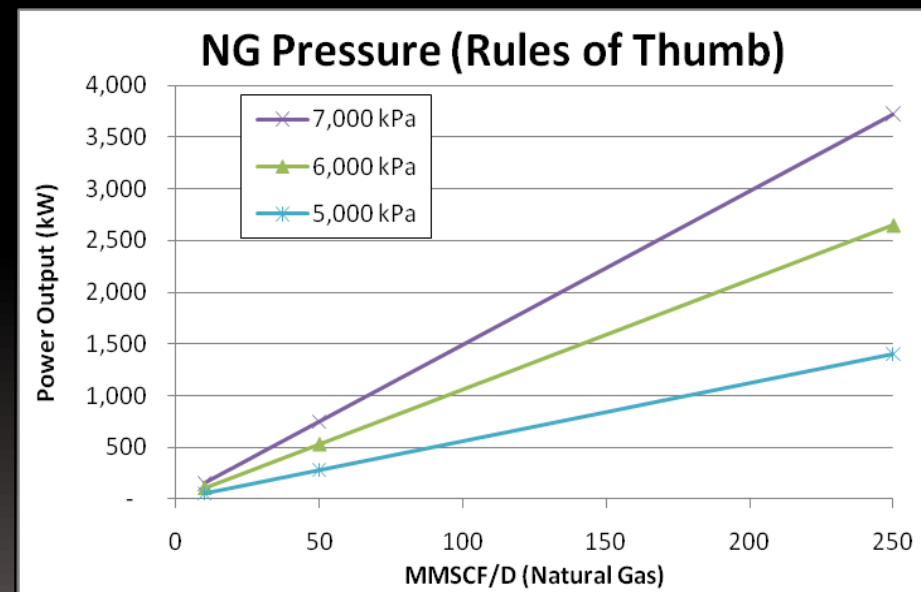
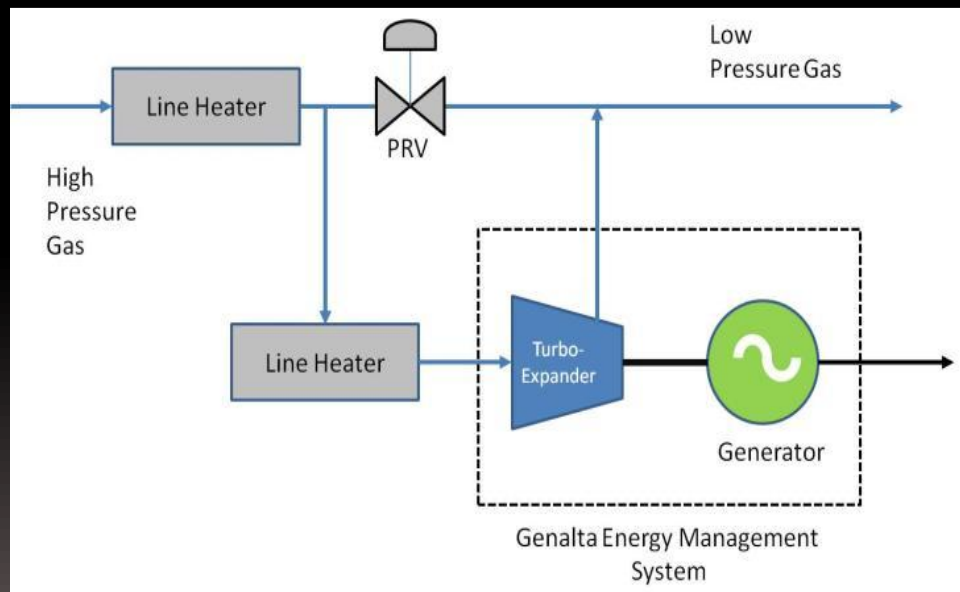
Application Specific

Pre-heat/after heat -

Waste heat can be utilized

RULE OF THUMB**

$$\text{kW}_{\text{net}} = \text{MMscf/d} \times 10$$

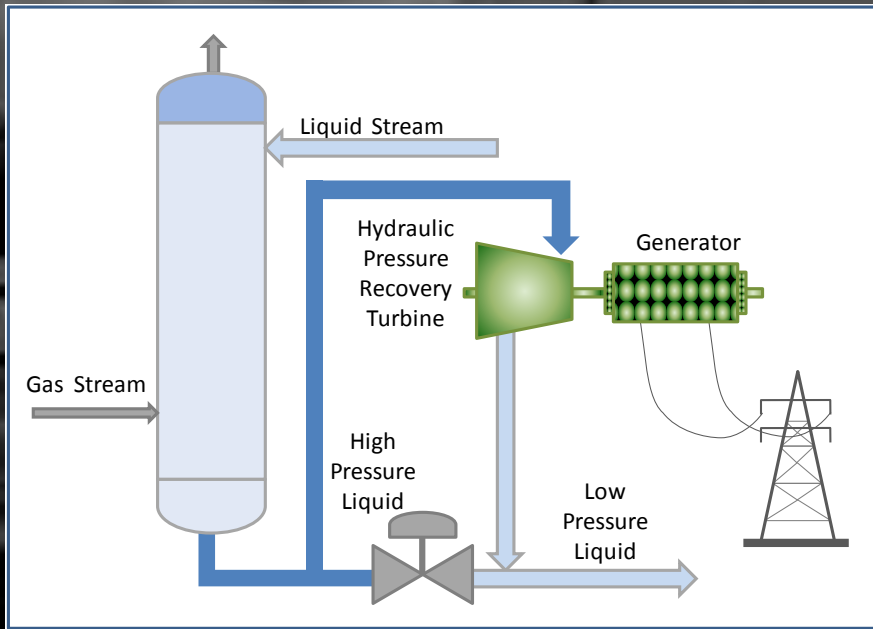


Note: Final Pressure = 4,000 kPa (580 Psi)

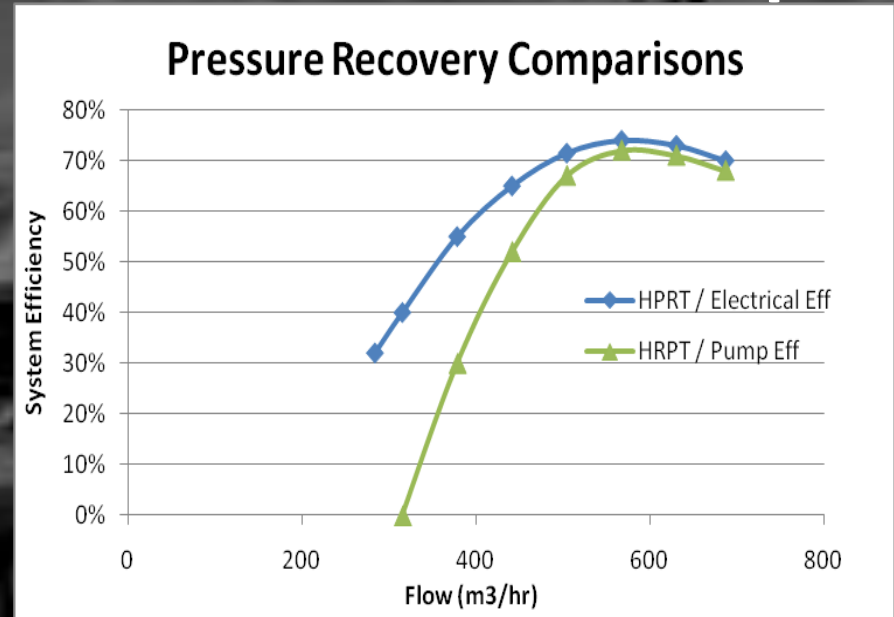
LIQUID PRESSURE LETDOWN

Hydraulic Power Recovery Turbine

Amine Systems



Generation vs Pump



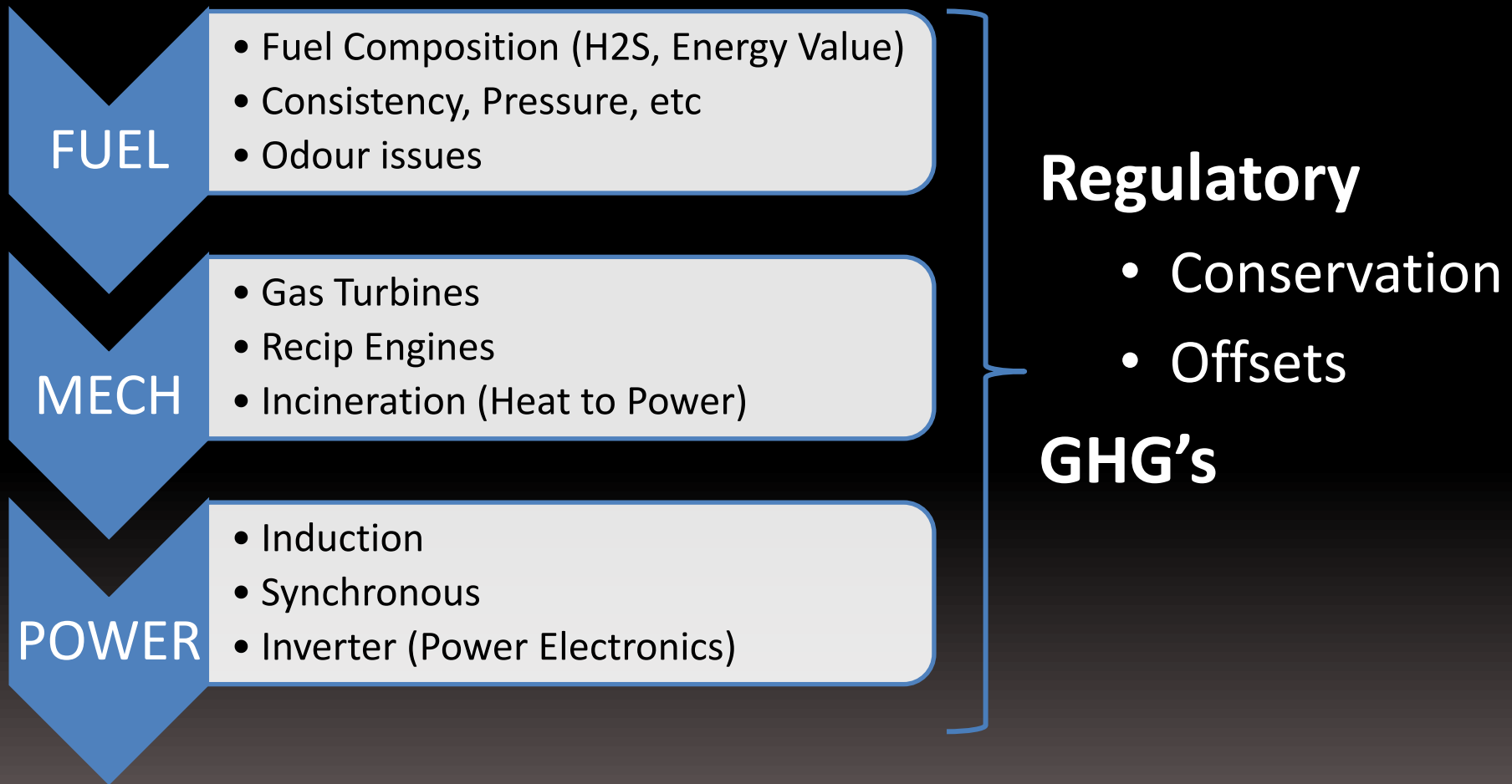
Min flow: 110m³/hr
500 GPM

RULE OF THUMB

$$\text{kW}_{\text{net}} = \text{GPM} / 3.5$$

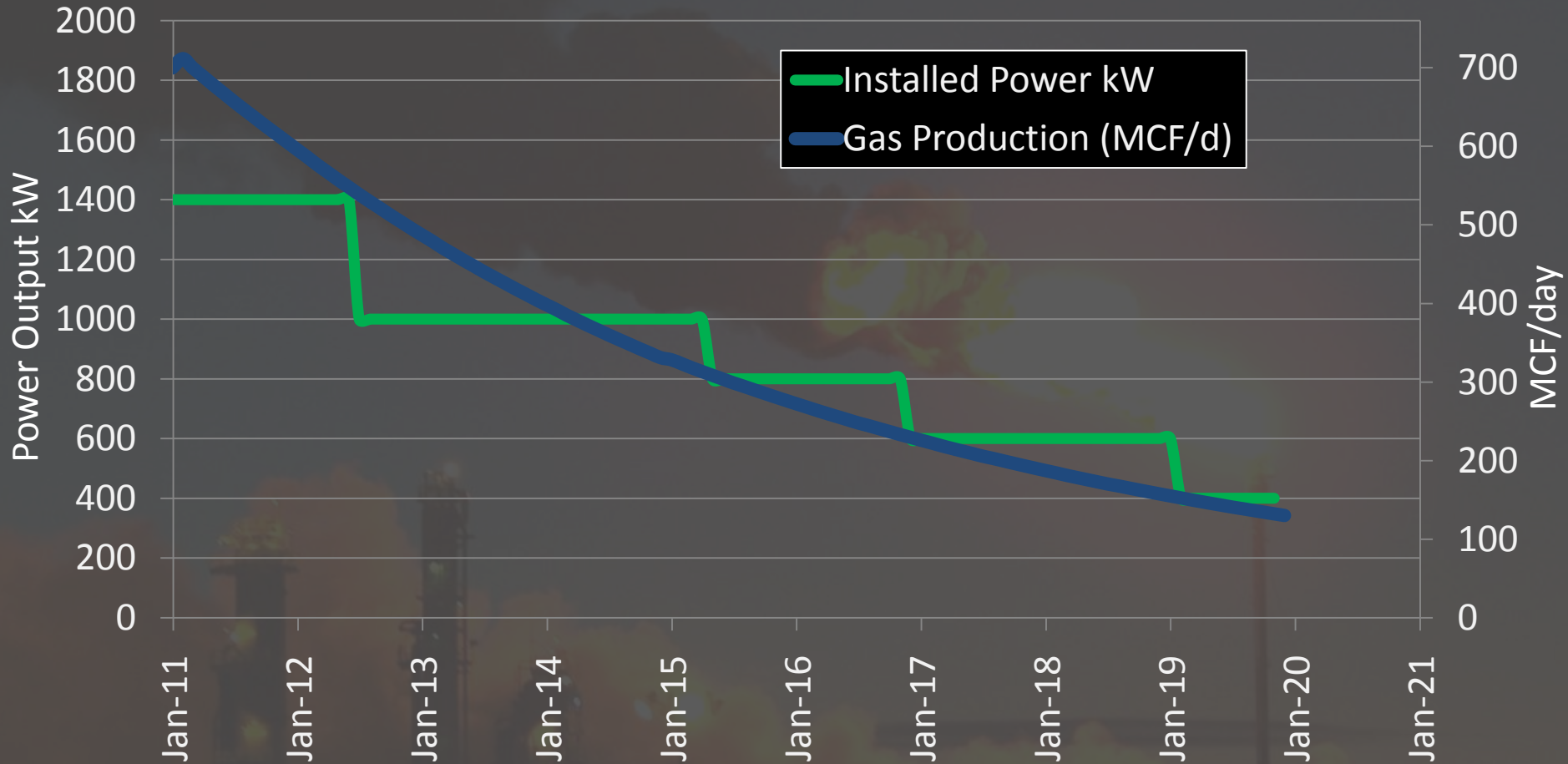
Waste Fuel to Power

CONVERT TO BASELOAD POWER



SITE EXAMPLE

Production vs. Power Generation



FLARED/STRANDED GAS

Site Selection

- 3 Phase Power in area
- Fuel gas analysis required

Turbine Waste Heat:

- Waste heat to power
- Process hot water

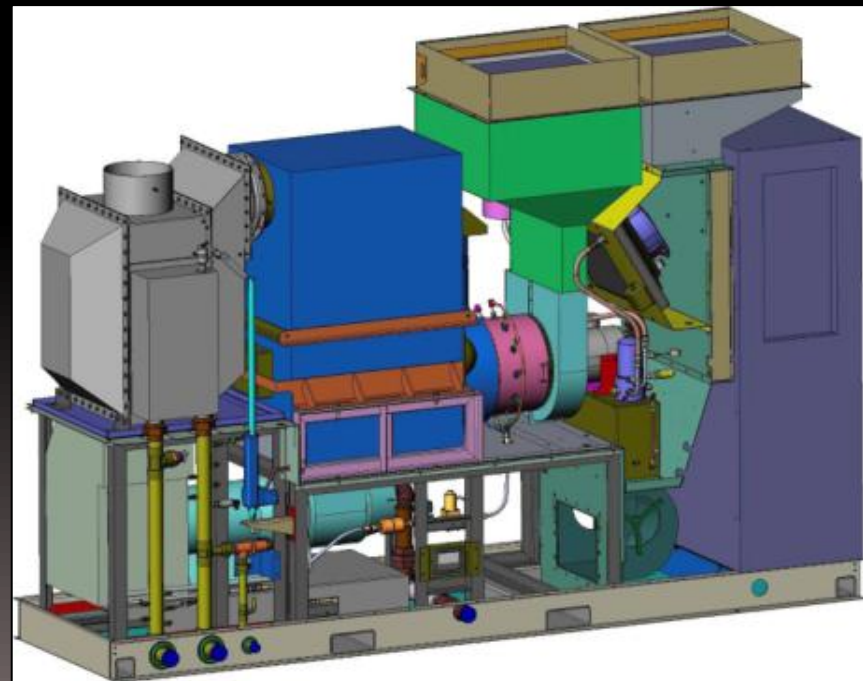
RULE OF THUMB

$$\text{kW}_{\text{net}} = \text{FLOW (mcf/d)} \times 3.8$$

Or

$$1 \text{ MW} = 260 \text{ mcf/d}$$

$$\text{Min: } 70 \text{ mcf/d (2 e}^3\text{m}^3\text{/d)}$$



POWER GENERATION

Electrical Output:

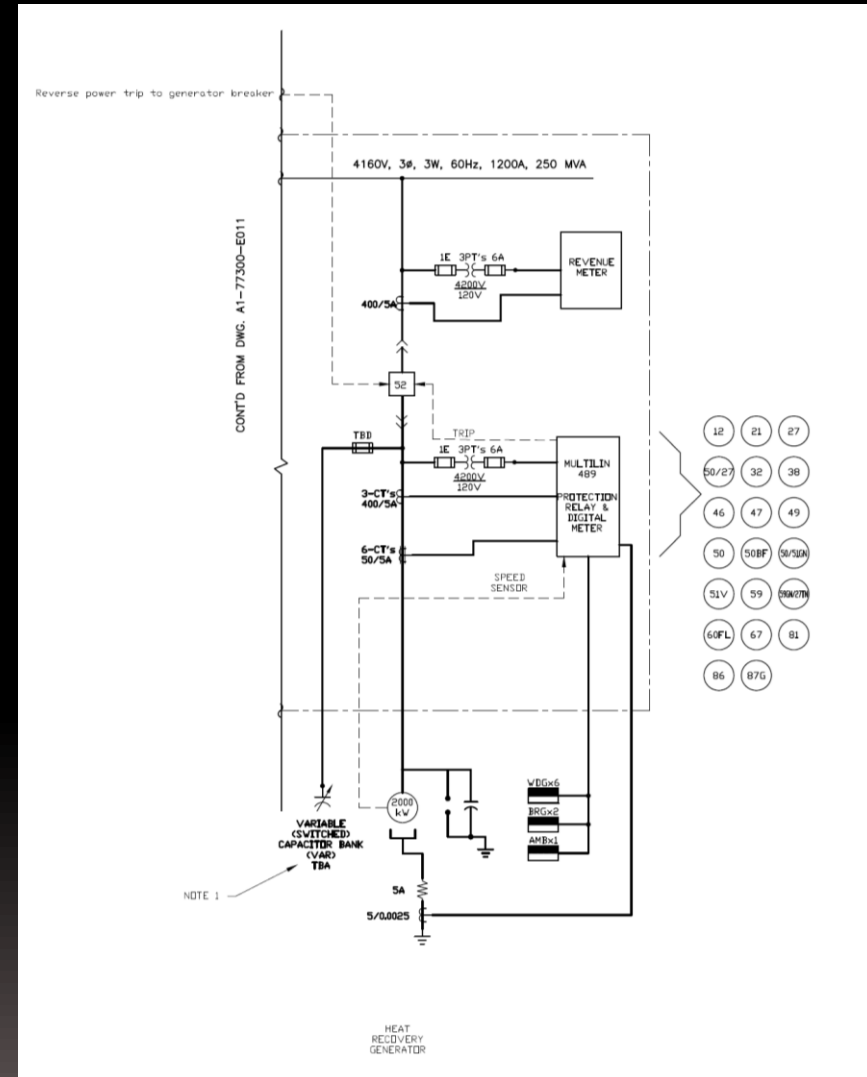
- 480, 600, 4160 volts, etc
- Inverter, Induction, Synchronous Generation

Interconnection:

- Grid Interconnect & Paralleling
- Off Grid

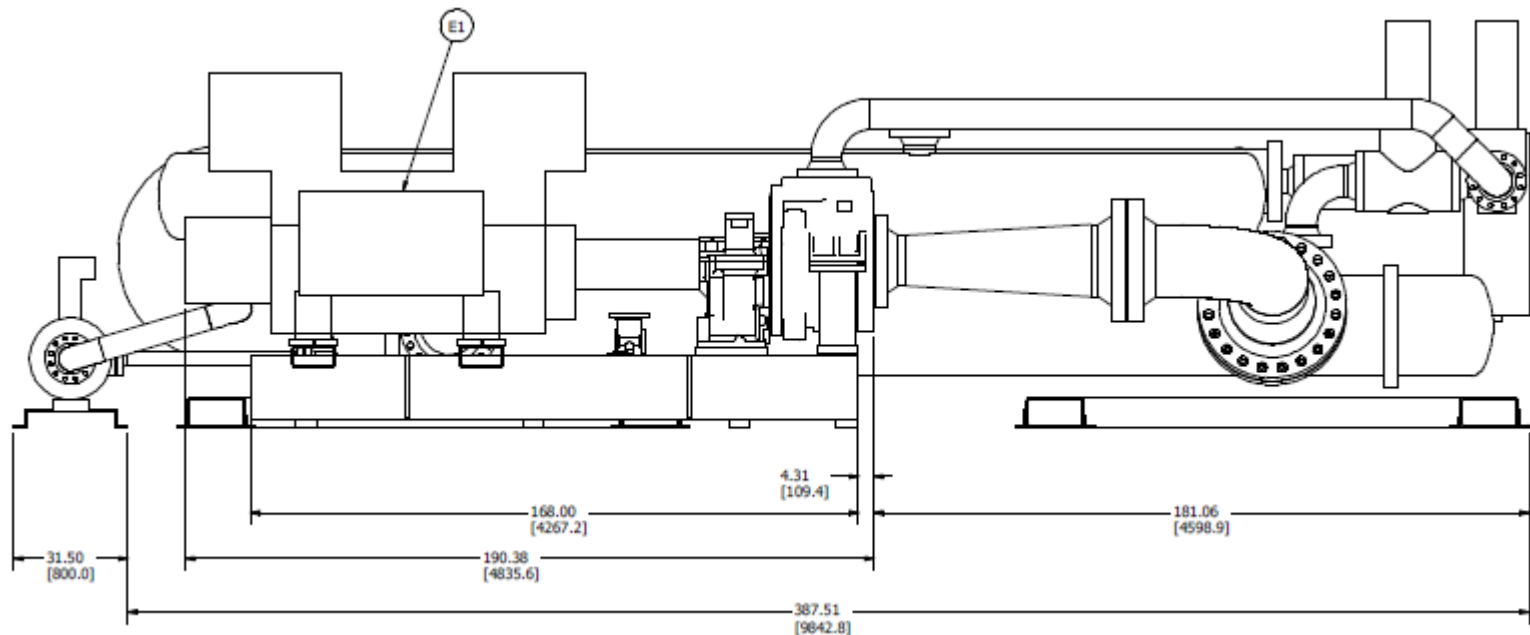
Control Systems:

- PLC Based
- Remote Monitoring



PROJECT OPTIMIZATION

- Balance of power output and installed equipment
- System optimization
- Focus on system integration (zero interruption to process)
- Designed to site conditions
- Tailored to client's needs



ADVANTAGES

ISSUE

REASON

Renewable Energy

GHG Reductions

Efficiency

Cost Savings

Environmental

Carbon Footprint Reductions

Policy

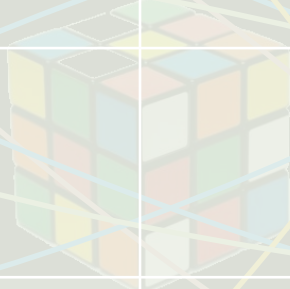
Going Green

Grid Interconnect

Control Systems

Component Selection

Operating Parameters



SCADA

Waste Energy Source

Working Fluids

Site Specific Requirements

BRINGING IT TOGETHER

**Recovered
Energy
Power
Producer**



**Site-
Specific
Solutions
Provider**