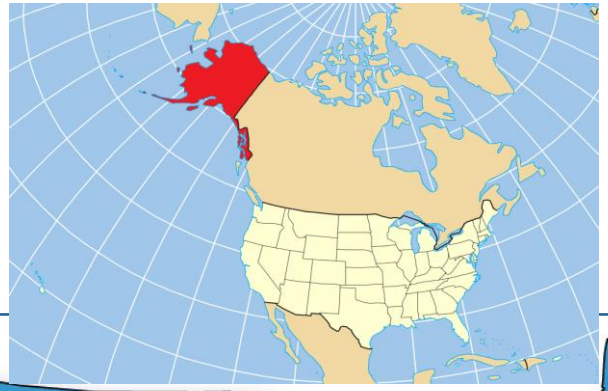
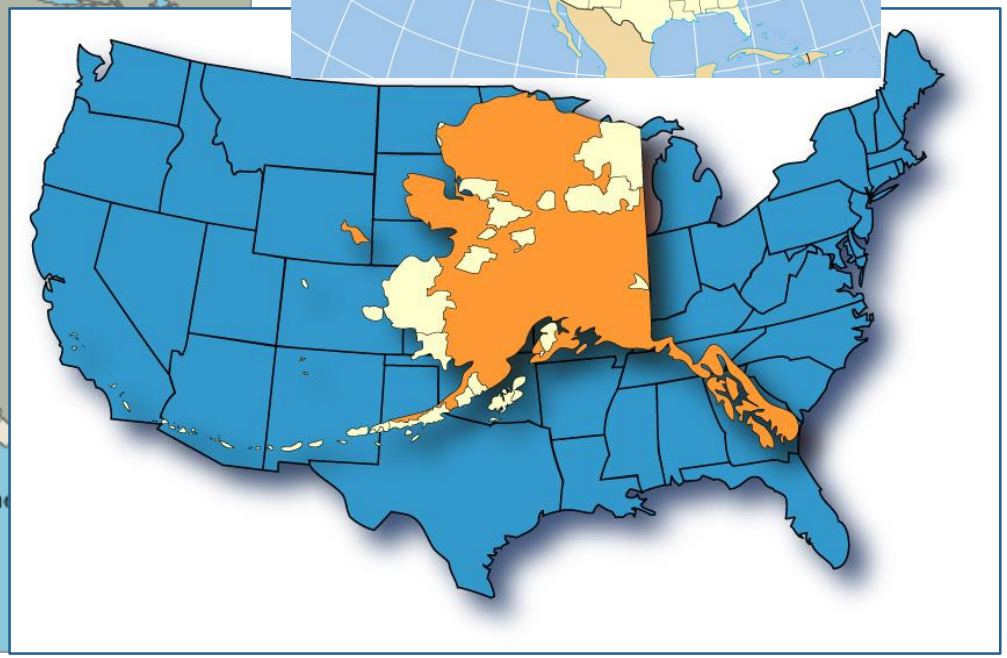
Modular Gasification for
Syngas/Engine Combine Heat and Power Applications in
Challenging Environments

(Funding by DOE/NETL Contract DE-FE0031446)

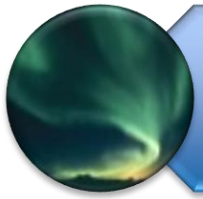
MAKING COAL RELEVANT FOR SMALL SCALE APPLICATIONS

WHERE IS FAIRBANKS?

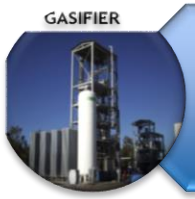




PROJECT PARTNERS



SLR & PDC:
Permitting and Environmental Assessments



HMI:
Intellectual Property
Decades Experience

WorleyParsons:
Detailed Engineering
Cost Estimating Service

Cost Share: Chena Power, Aurora Energy, UAF, Sotacarbo, HMI,GVEA, Innio, Western Energy Services

PROJECT DESCRIPTION AND OBJECTIVE

Demonstrate small scale coal gasification to fuel reciprocating engine generators

- Cost effective coal generating capacity for small applications
- Provides load following services
- Ideal for islanding systems
- Local jobs

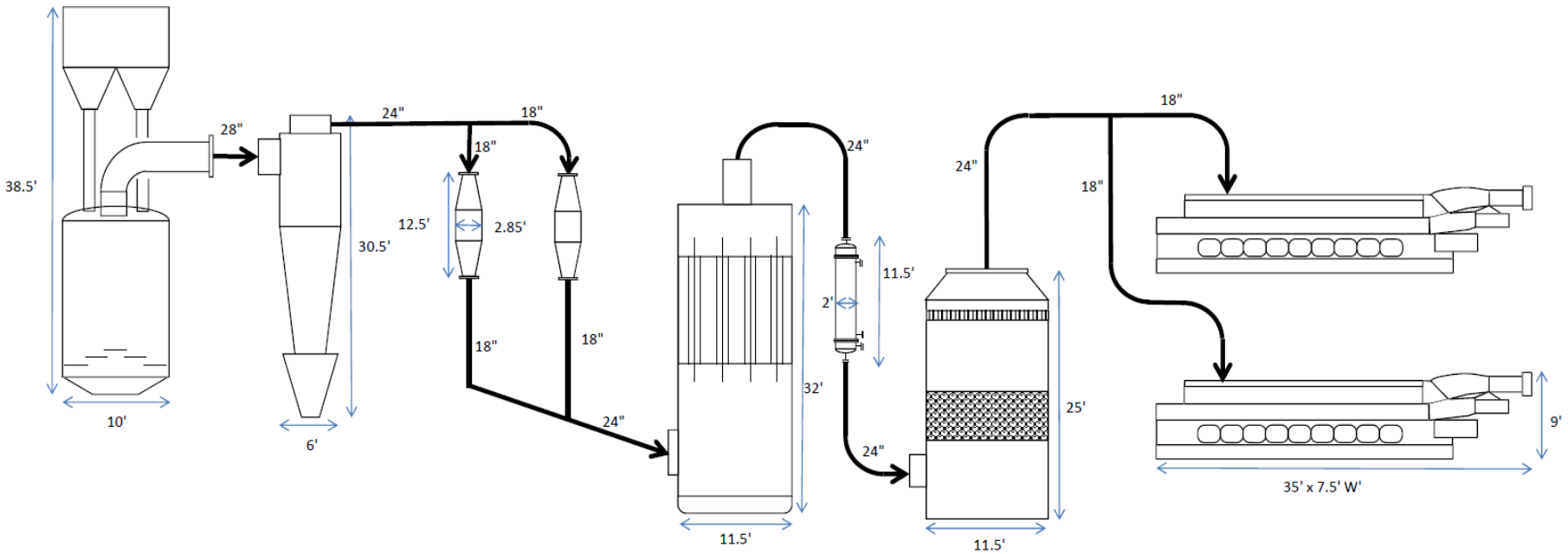
ALIGNMENT WITH DOE GOALS

- ✓ Small—50-350 MW
  - ✓ This project: 18 MWe
  - ✓ First step toward "modularizing"
- ✓ Near Zero Emissions
  - ✓ Built in a "Serious non-Attainment area for PM2.5"
- ✓ Minimize water usage
  - ✓ Water cleaned up for greenhouse use
- ✓ Capable of natural gas co-firing
  - ✓ Engines are easily convertible to firing natural gas or propane
- ✓ Capable of high ramp rates
  - ✓ Designed for wind regulation

Not specifically part of DOE's stated goals, but noteworthy:

- ✓ Pyrolysis tars/oils can be used in diesel engines
- ✓ Deigned to co-fire biomass

UAF'S MODIFIED DESIGN



HMI Gasifier

Fisher Klosterman Cyclone

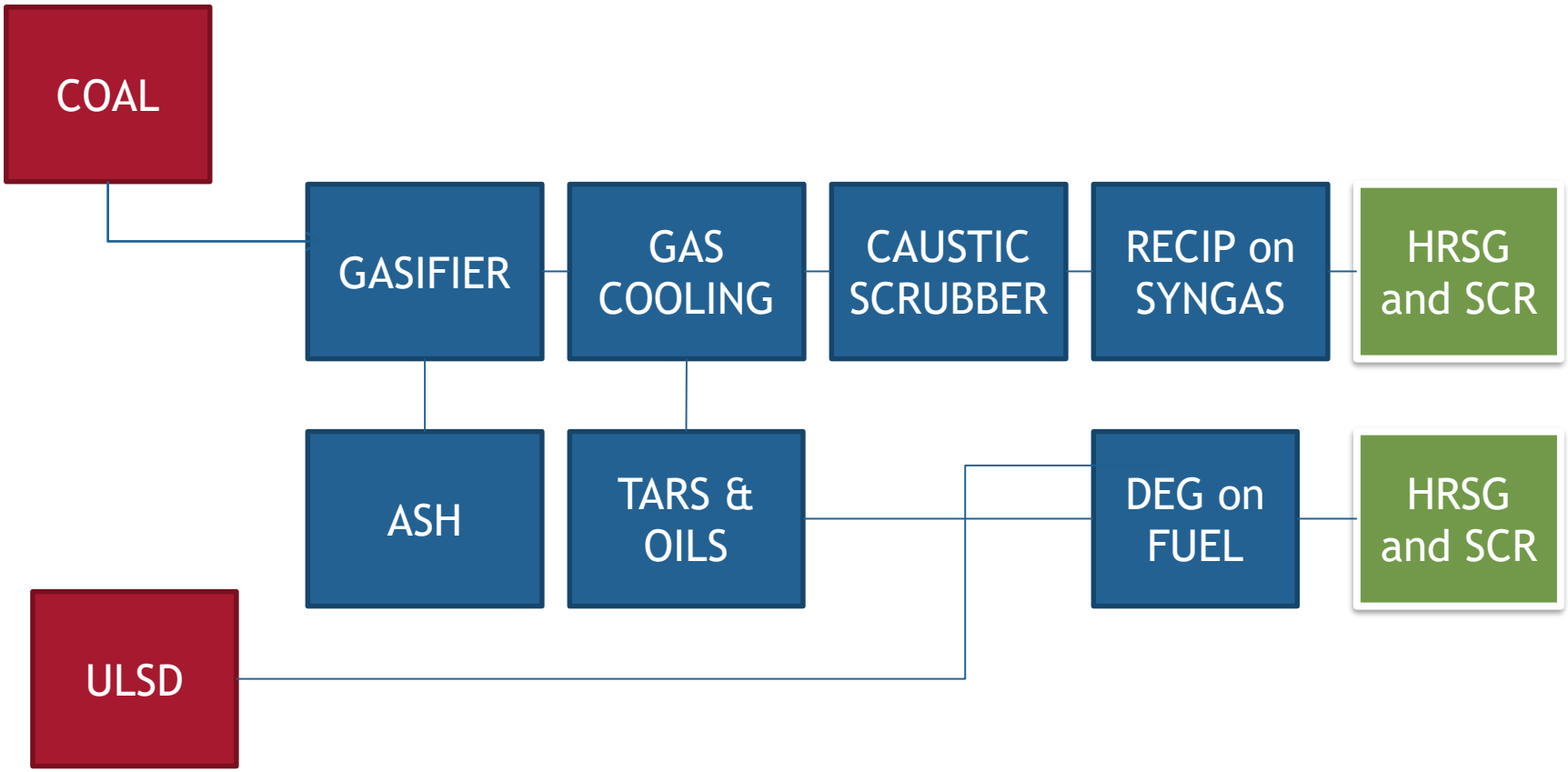
Alfa Laval Syngas Cooler

Bellini Wet ESP and Final Condenser

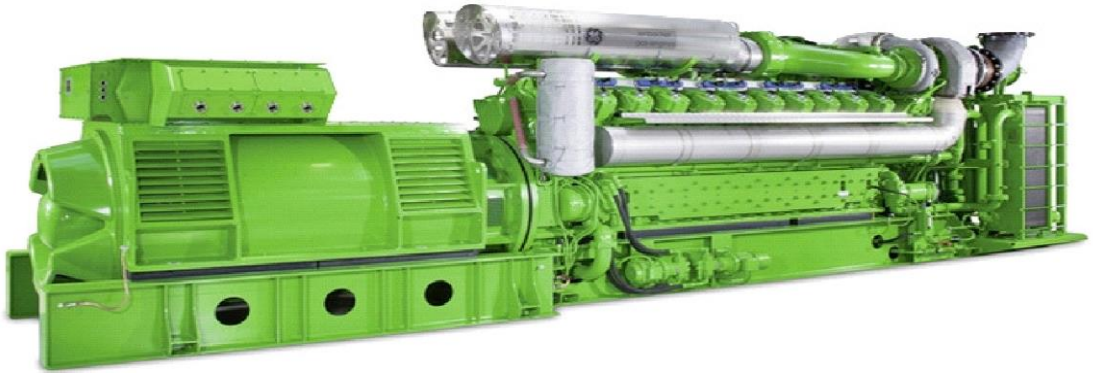
Bellini Caustic Scrubber

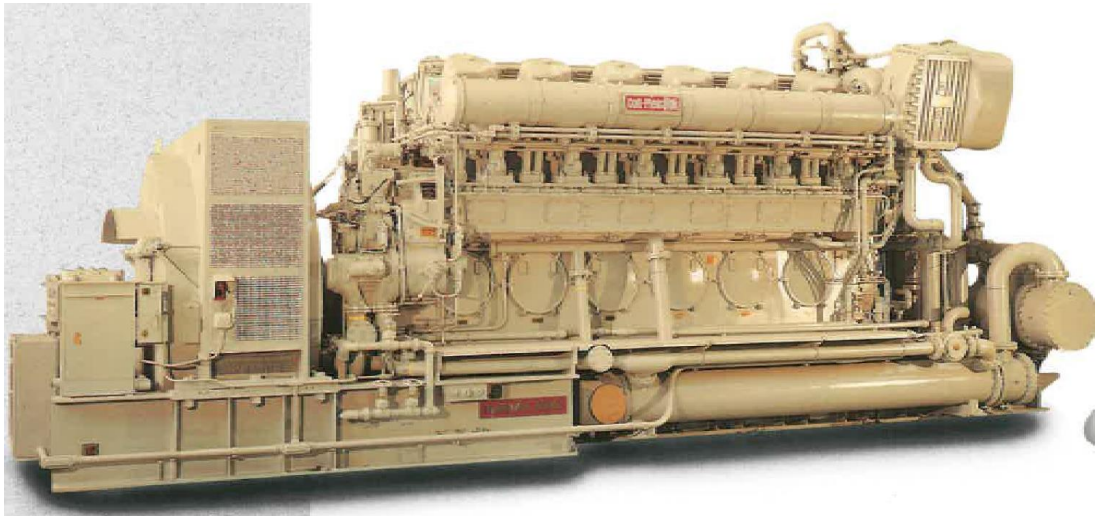
GE Jenbacher Engines

UAF'S MODIFIED DESIGN



THE EQUIPMENT





FOUND A HOME!

WHY COAL GASIFICATION?

COSTS FOR REGULATING 10 MWe OF WIND POWER

	Syngas Project (UAF)	Diesel (GVEA)	Natural Gas (not an option)
Capital Cost (option 3)	$85 million	--	--
Fuel Costs + other O&M	$76.6/MWh ($10/mmbtu)	$147.2/MWh ($15/mmbtu)	$200/MWh ($20/mmbtu)
Wind Regulation Costs (10 MWe regulating capacity)	$3.1 M/yr (GVEA's cost to regulate wind with syngas)	$6.5 M/yr (avoidable costs)	--
Total Generation (syngas and liquid fuels)	18 MW 10.0 MW avg 5 to 18 MW swing	240 MW 43.2 MW avg 35 to 48 MW swing	--
Efficiency, HHV	39%	<15% (turbines)	--

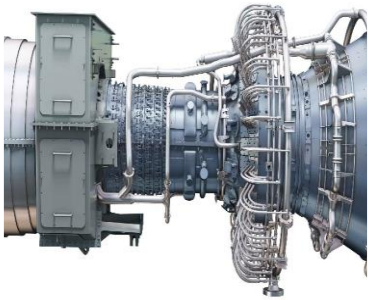
THE PROBLEM: INTERMITTENT GENERATION

Eva Creek

"Free" Energy

+

Combustion Turbine



Expensive Energy

=

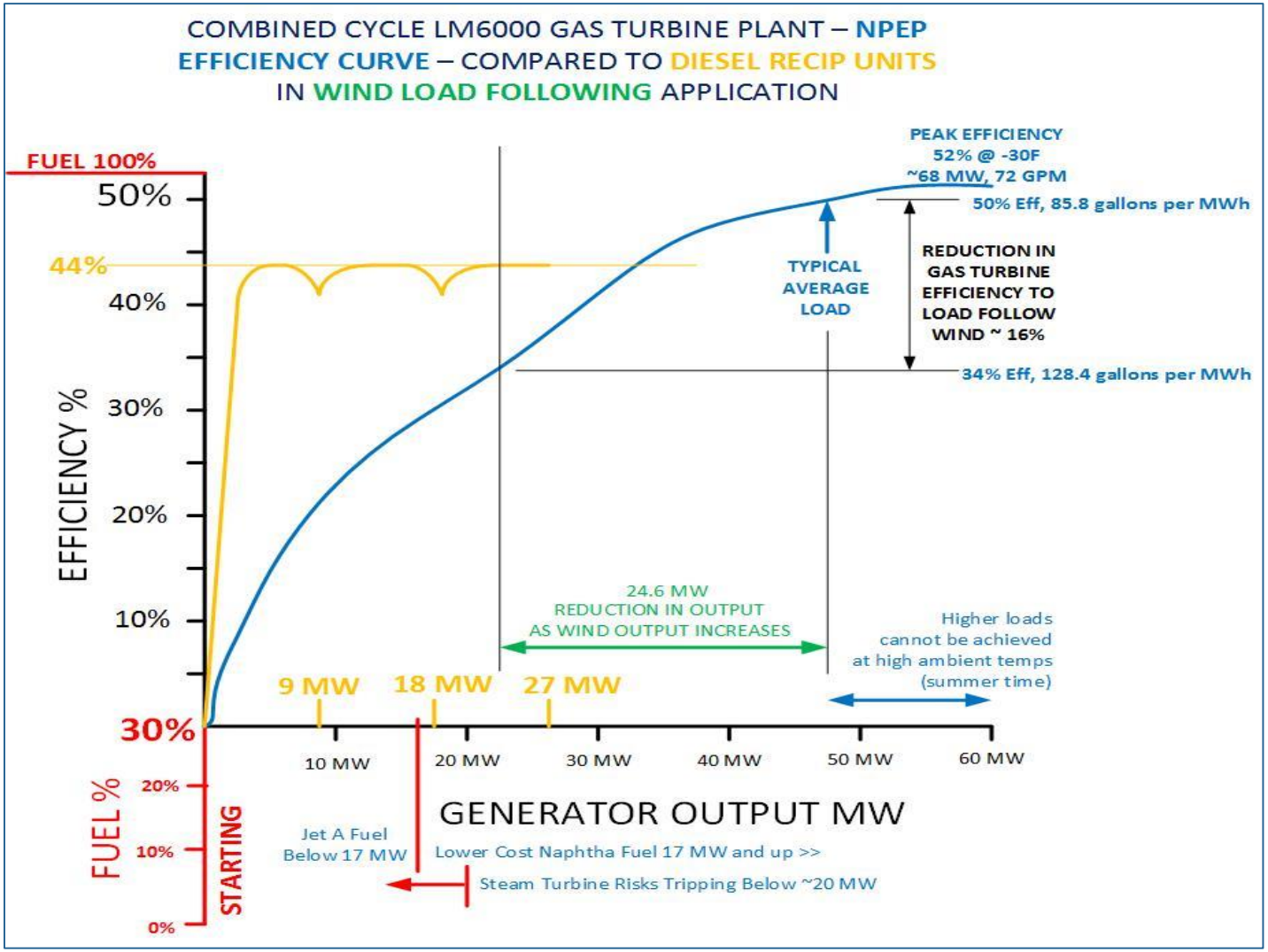
Coal

Cheapest Energy

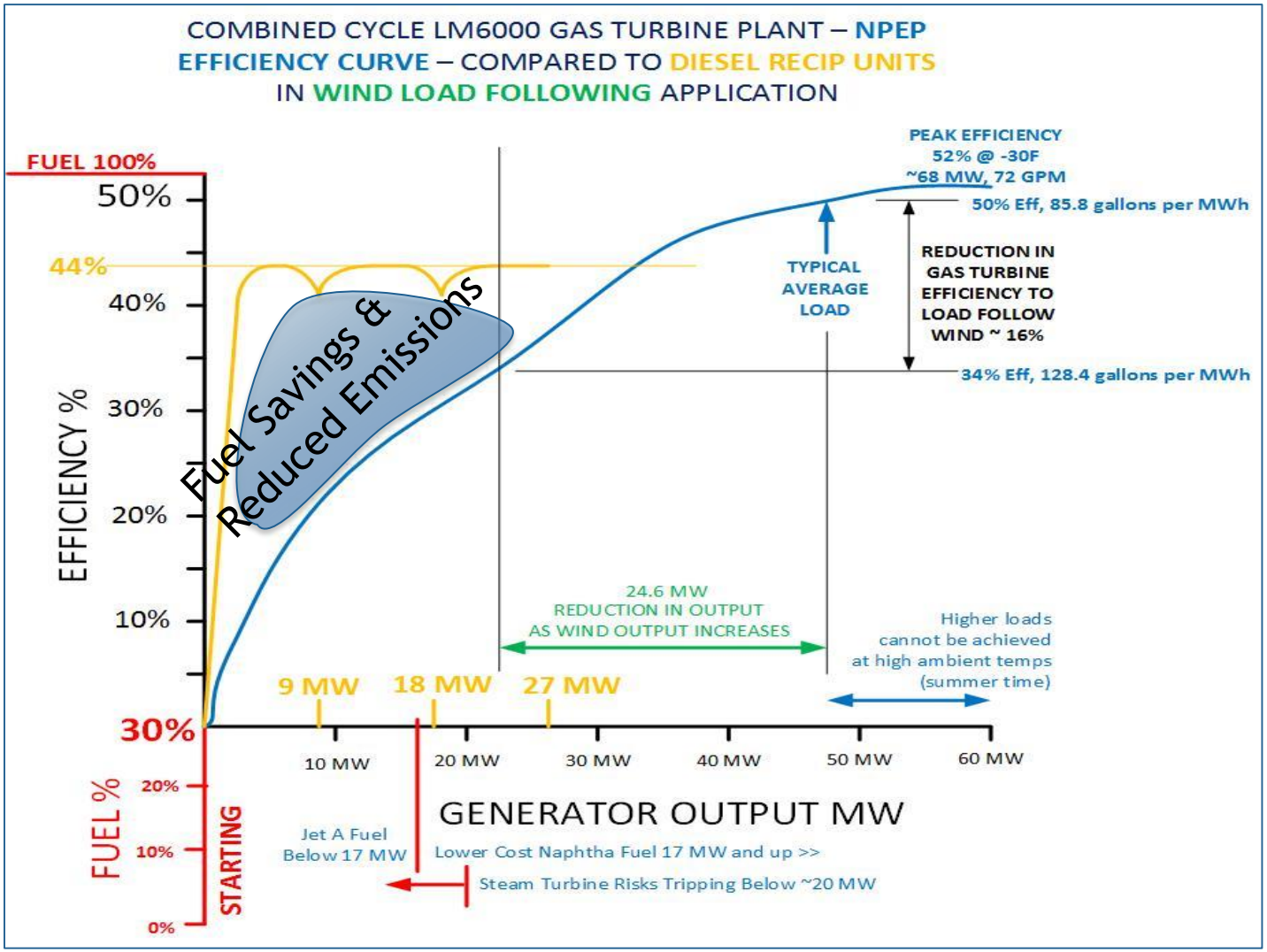
THE SOLUTION:
COAL ENABLING WIND

Eva Creek		Recip. Generator		Coal		Combustion Turbine
	+		=		+	
“Free” Energy		Cheapest Energy		Cheapest Energy		Expensive Energy

EFFICIENCY vs. LOAD



EFFICIENCY vs. LOAD

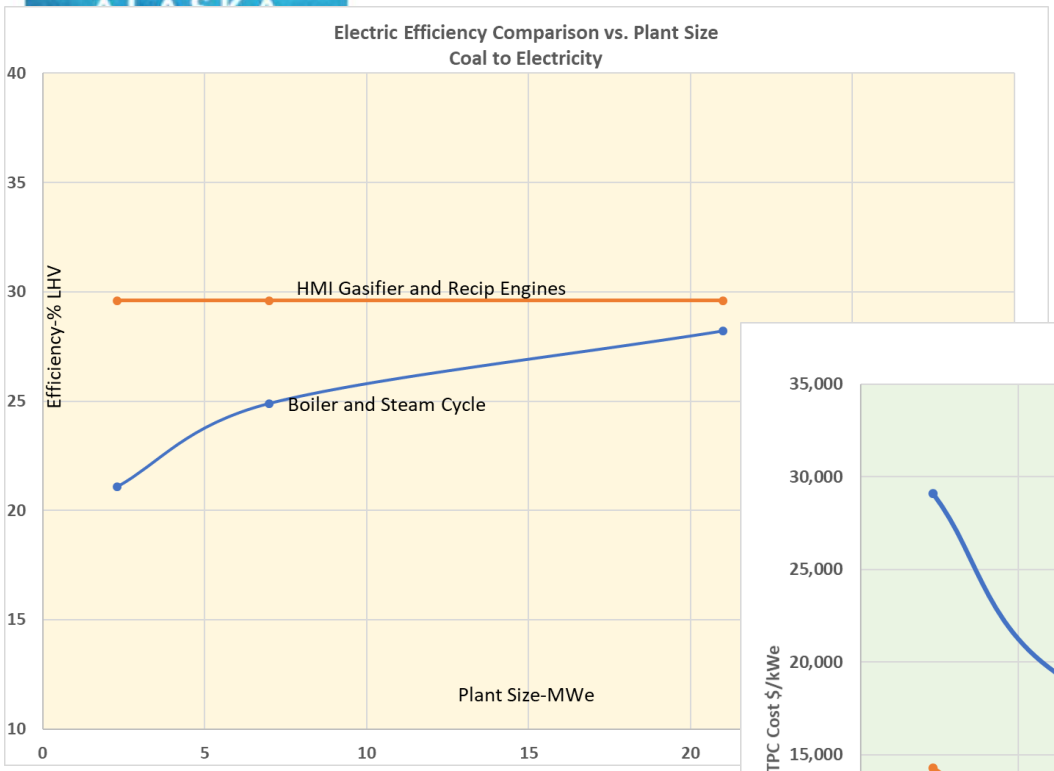


REGULATORY/PERMITTING

The EPA designated the Fairbanks vicinity as a “serious nonattainment area for PM2.5”

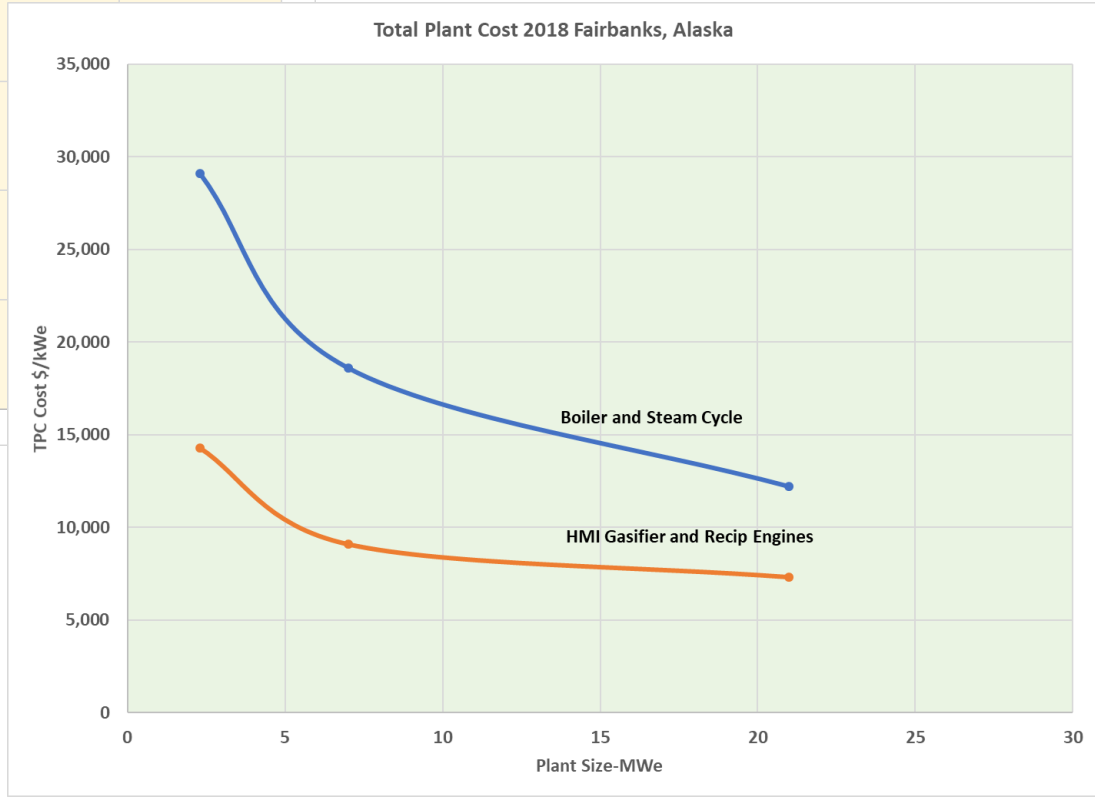
- PM2.5 and precursors (NOx, SO2, volatile organic compounds, and ammonia) will be regulated under the nonattainment New Source Performance Standard
- Even with Best Available Control Technology, this project is economical

MODULARITY and SCALING

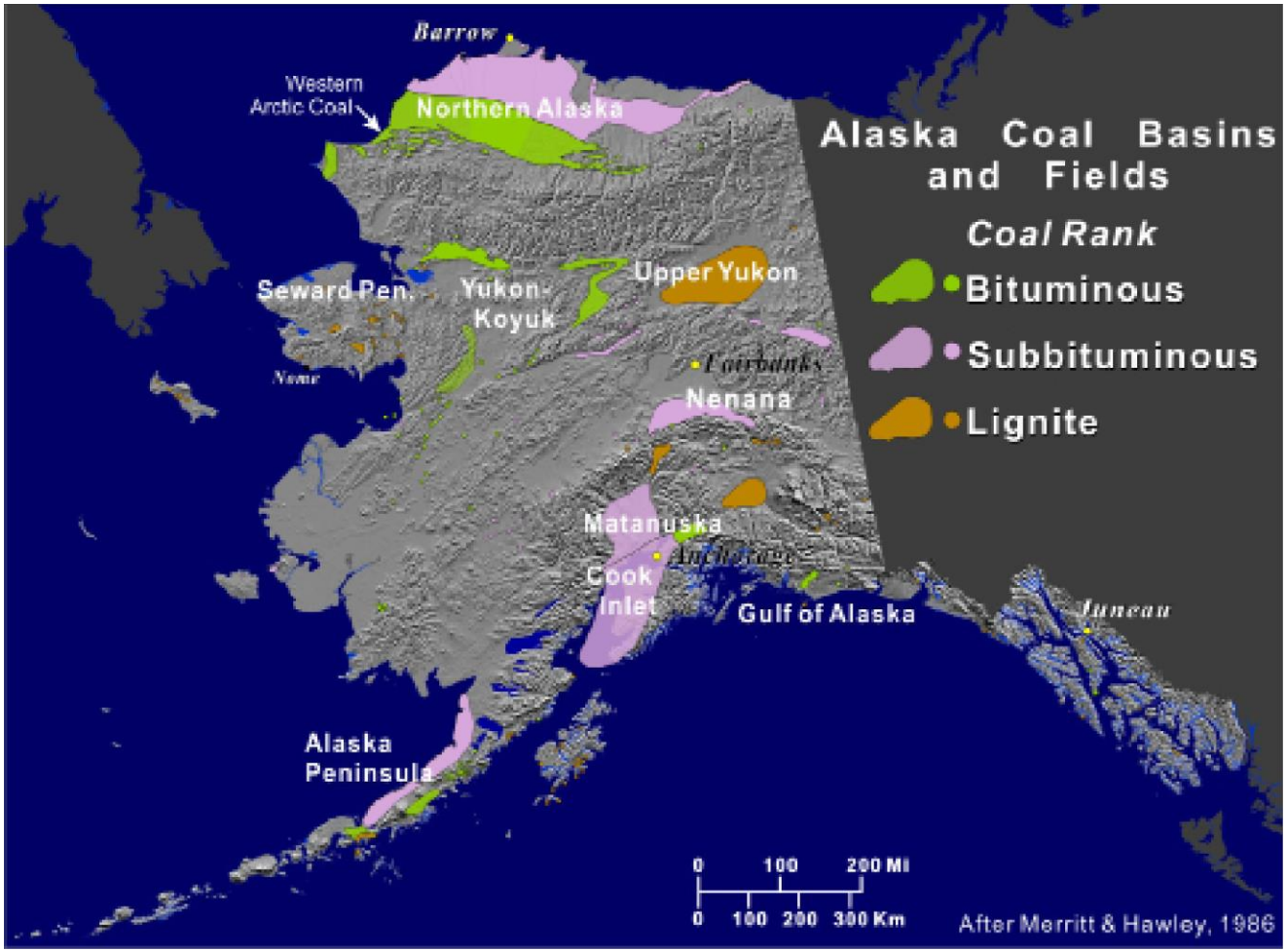


Gasifier/Engine System is Modular and Scalable

Multiple gasifier trains and engines can create powerplants from 1 MWe to 30 MWe+



AK-DGGS IDENTIFIED 37 VILLAGES WITH COAL NEARBY



RADICALLY ENGINEERED SYSTEM

- Make it work at 10 to 18 MWe
  - Economies of Scale working against us
- Make it work at village scale <2MWe
- Integrate with diesel infrastructure
- Make it work with biomass and waste products

USEFUL IN LOWER-48, TOO!

- Coal plants are best suited for baseload operation because it requires a long period to ramp up and to ramp down
- Syngas/Engine combinations has the potential for making coal a cost competitive resource meeting flexible energy demand and fluctuating generation

BUT MOST IMPORTANTLY …POWER ALASKA'S INTERIOR

RISK FACTORS

- Except for the HMI Gasifier, all components are available commercially
  - HMI gasifier components are well understood and documented
- Emission controls could be *the* key factor to be addressed
  - Fairbanks is in an EPA designated “Serious non-attainment area for PM 2.5”

MEET THE TEAM

- Diane Revay Madden, NETL
- Brent J Sheets, UAF
- Rolf Maurer & Team, HMI
- Harvey Goldstein & Team, WorleyParsons
- Chilkoot Ward & David Fish, Aurora Energy
- Randy Hobbs, Hobbs Industries
- Alberto Pettinau, Sotacarbo
- Isaac Bertschi & Courtney Kimba
  SLR
- Erica Betts, PDC

QUESTIONS?

Brent J Sheets

907-750-0650

bjsheets2@alaska.edu

http://pdl.uaf.edu/