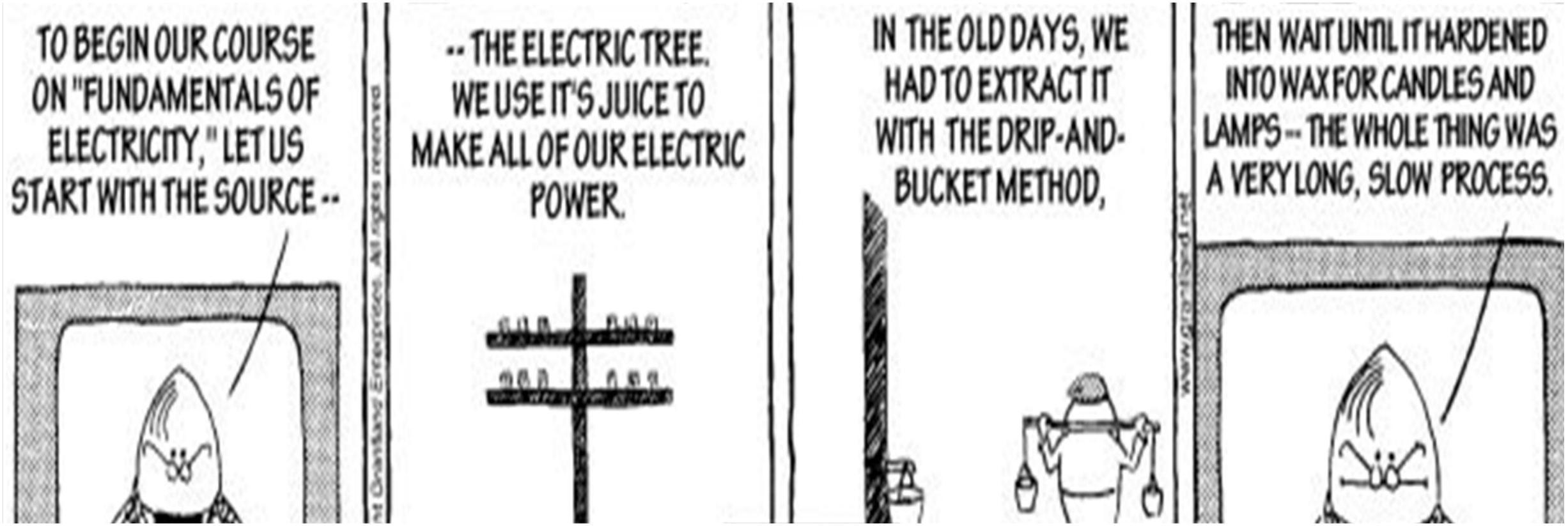
Is the glass half full or half empty?..

- The optimist says the glass is half full.
- The pessimist says the glass is half empty.
- The project manager says the glass is twice as big as it needs to be.
- The first engineer says the glass is over-designed for the quantity of water.
- The second engineer says he's glad he put the other half in a redundant glass.
- The consultant says let's examine the question, prepare a strategy for an answer, and all for a daily rate of...
- The realist says the glass contains half the required amount of liquid for it to overflow.
- And the cynic... wonders who drank the other half.
- The teacher says it's not about whether the glass is half empty or half full, it's whether there is something in the glass at all.

Anyway... Attitude is not about whether the glass is half full or half empty, it's about who is paying for the next round.


TO BEGIN OUR COURSE ON "FUNDAMENTALS OF ELECTRICITY," LET US START WITH THE SOURCE --
-- THE ELECTRIC TREE. WE USE IT'S JUICE TO MAKE ALL OF OUR ELECTRIC POWER.
IN THE OLD DAYS, WE HAD TO EXTRACT IT WITH THE DRIP-AND-BUCKET METHOD,
THEN WAIT UNTIL IT HARDENED INTO WAX FOR CANDLES AND LAMPS -- THE WHOLE THING WAS A VERY LONG, SLOW PROCESS.

Working with Local Agencies to Develop Local Power Collaboration

Alan Fetters
Rural Assistance Manager

2018 School District Maintenance Employees Conference
Thursday, October 18 2018





AEA's mission is to reduce the cost of energy in Alaska







Assistance with statewide project development, financing, and long-term management of energy infrastructure

- Diesel powerhouses
- Heat Recovery
- Bulk Fuel
- Power Cost Equalization
- Renewable (wind, bio, hydro, solar)
- End-use efficiency
- Railbelt assets



Quinhagak, AK

Technical Assistance – Maintaining Infrastructure

Rural Utility Assistance

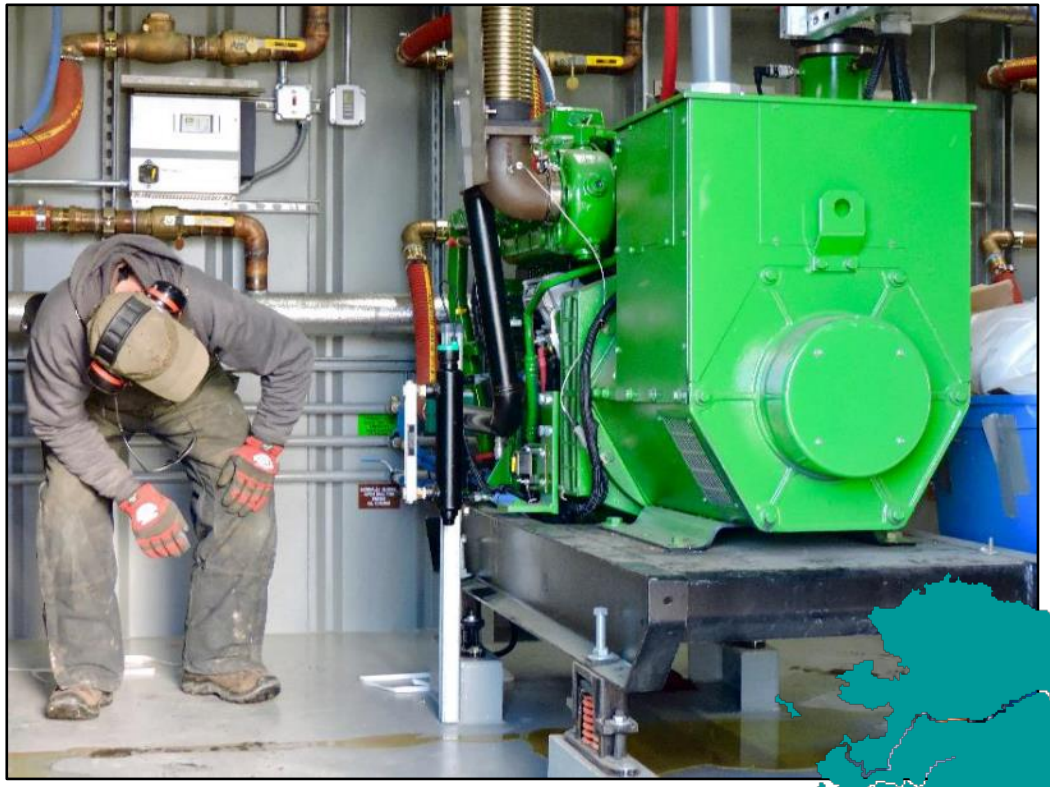
- Circuit Rider
- Electrical emergency response
- Business administration

Training

- AVTEC Partnership
- Denali Commission funding
- Bulk Fuel Operator
- Power Plant Operator
- Biomass Operator
- Utility Clerk



Diesel Rules: primary power in 90% of rural Alaska



Perryville, RPSU Commissioning 2017



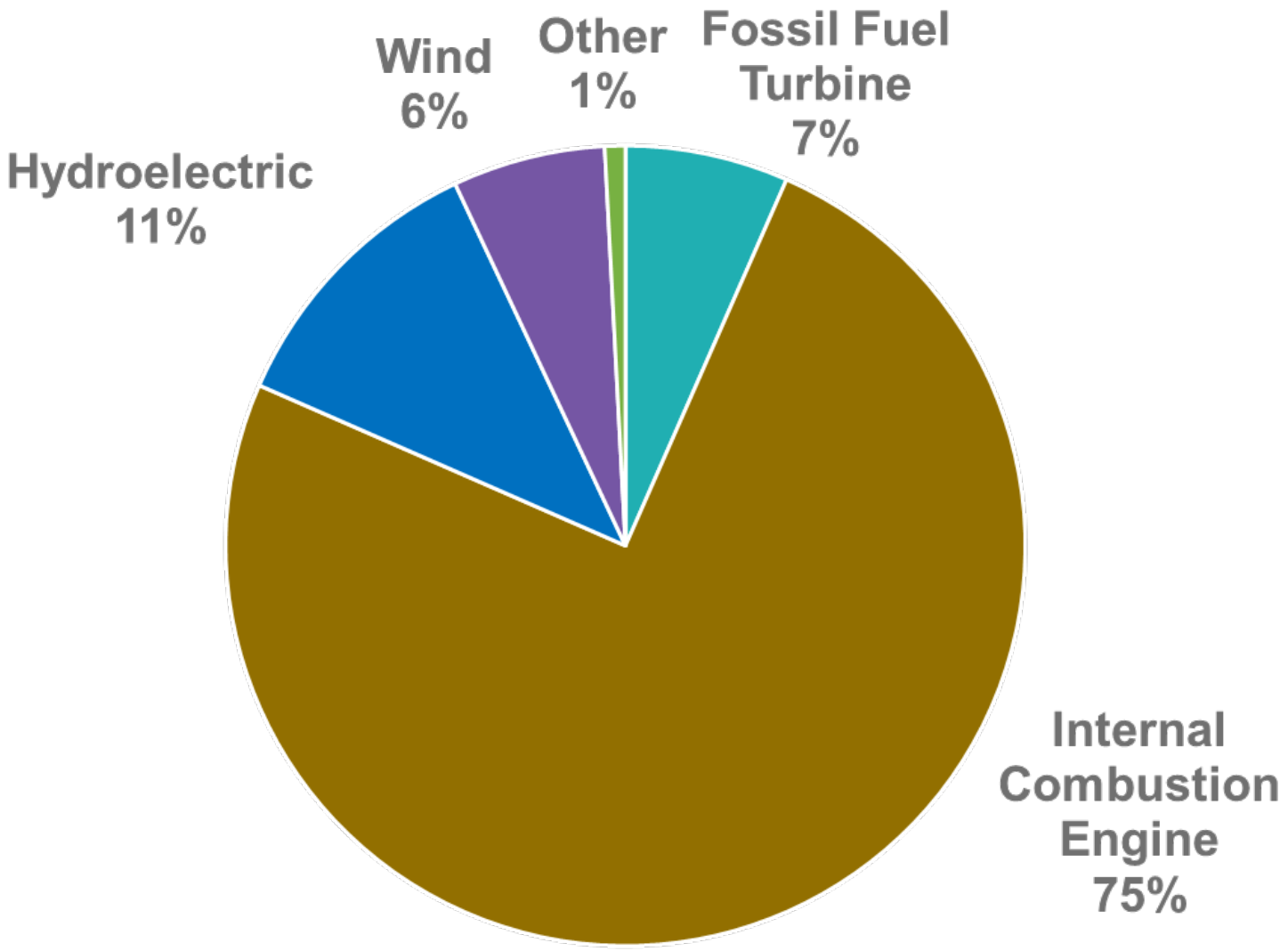
Kwigillingok Bulk Fuel Facility





Statewide Installed Generation Capacity in Alaska

Excluding Railbelt and Southeast



AEA Heat Recovery Program:
Mission & Strategy

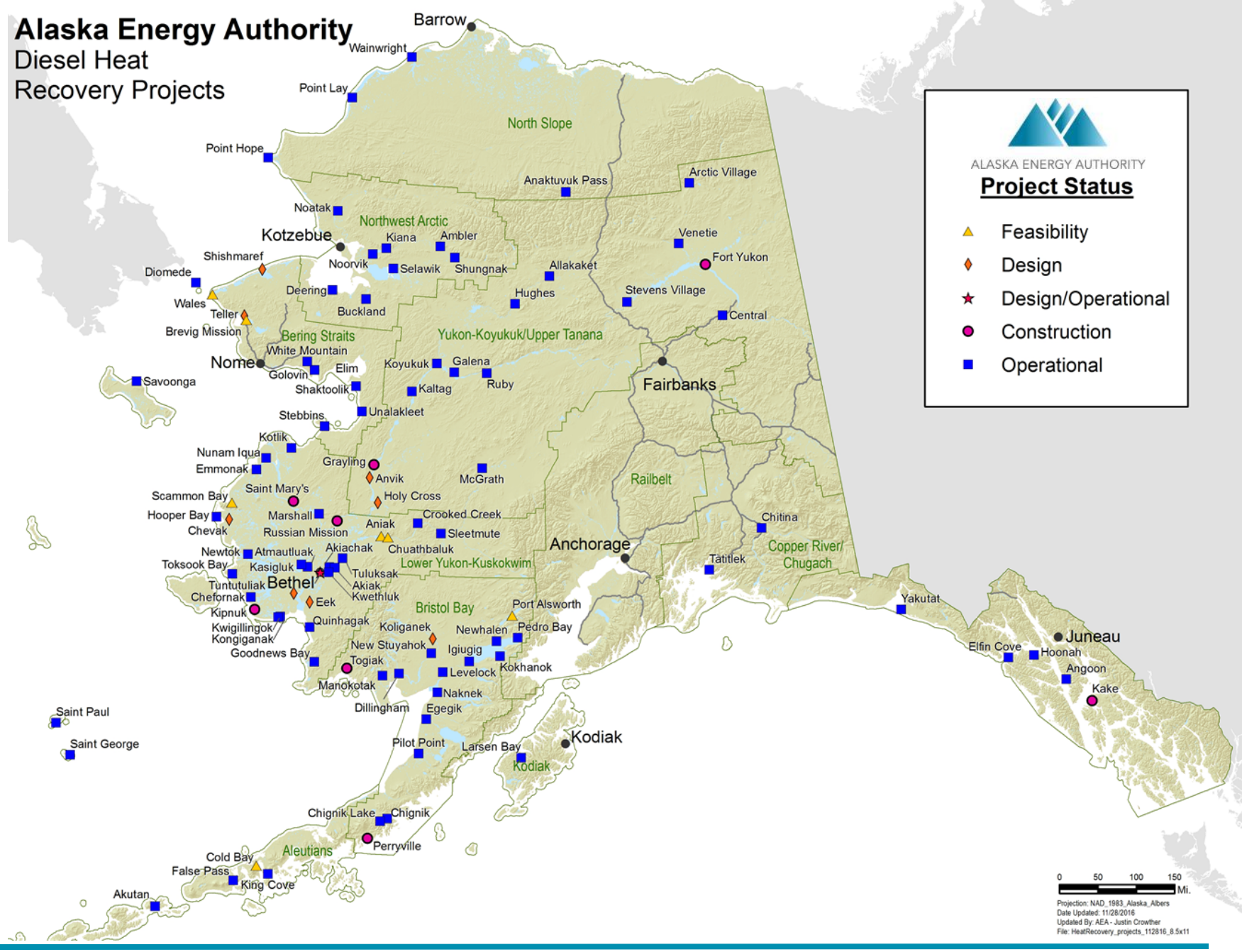
- Mission
  - Utilize recovered heat from power plants and other heat sources to reduce the cost of energy in Alaska
  - Feasibility studies for potential heating projects
  - Provide technical support
  - Conduct educational and outreach events
- Strategy
  - Include Heat Recovery in all *possible* Generator upgrades
  - Develop partnerships
    - Share technology
    - Secure grants
    - Heat sales agreements

AEA Heat Recovery Program:
Funding & Prioritization

- Funding
  - AEA with Washington State University and the US Department of Energy
  - ANTHC conducts many separate feasibility studies
  - Historically the Renewable Energy Fund has funded several Heat Recovery Projects
  - Eligible for Power Project Loan fund
- Prioritization
  - State-wide planning experts and AEA RPSU evaluate generation systems
  - Existing systems, Renewable energy potentials, other projects
  - Requests from Communities

Accomplishments

- **7** Prefeasibility Studies
- **16** Projects in Design or Construction phase
- Over **75** Heat Recovery systems operational across the state
- Additional projects in conceptual phase



What is Heat Recovery?

- Find a process that gives off heat.
  - Diesel Generators
  - Manufacturing
- Capture excess heat, use it to heat buildings or other processes.
  - Full utilization of fuel's energy content



What is a Heat Recovery System?



Heat Recovery System Basics

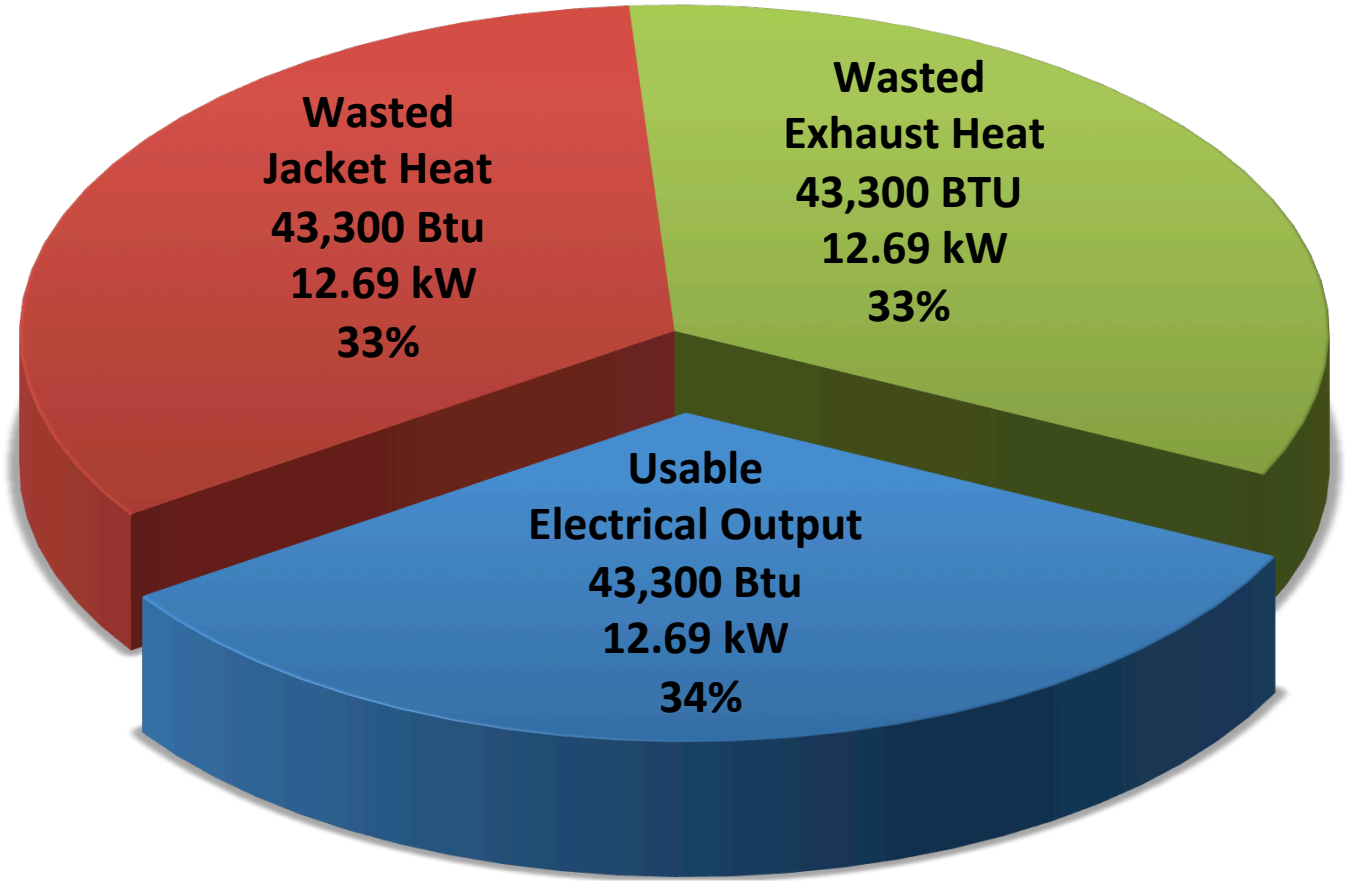
- Capture and use heat that would otherwise be wasted
- Purpose is to reduce heating fuel consumption
- NOT to be the primary heat source (End user buildings need to maintain a working heating system)
- Basic configuration is fairly standard
- Reliability is highest when system is kept simple

Heat Recovery System performance

- 30 to 35% of fuel energy used in diesel powerhouse is converted to electricity
- The remainder ends up as heat via radiator, charge air, exhaust and radiant
- 15-20% of heat can be captured (dependent on engine type and system configuration
- Typically 60% of heat available can actually be used (losses, seasonal need, etc)
- 10 to 15% net heat utilized.

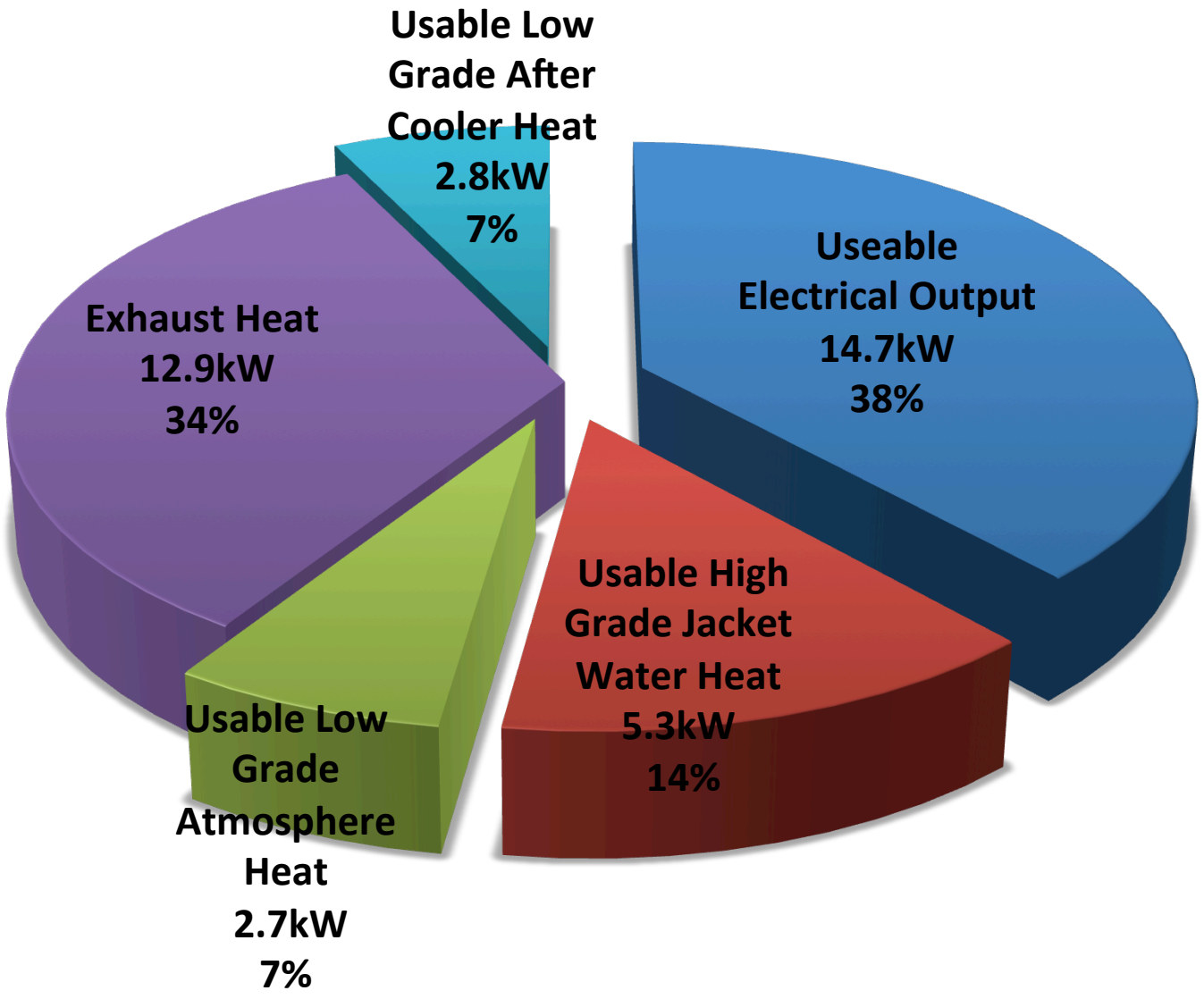
Diesel Generator Energy Outputs

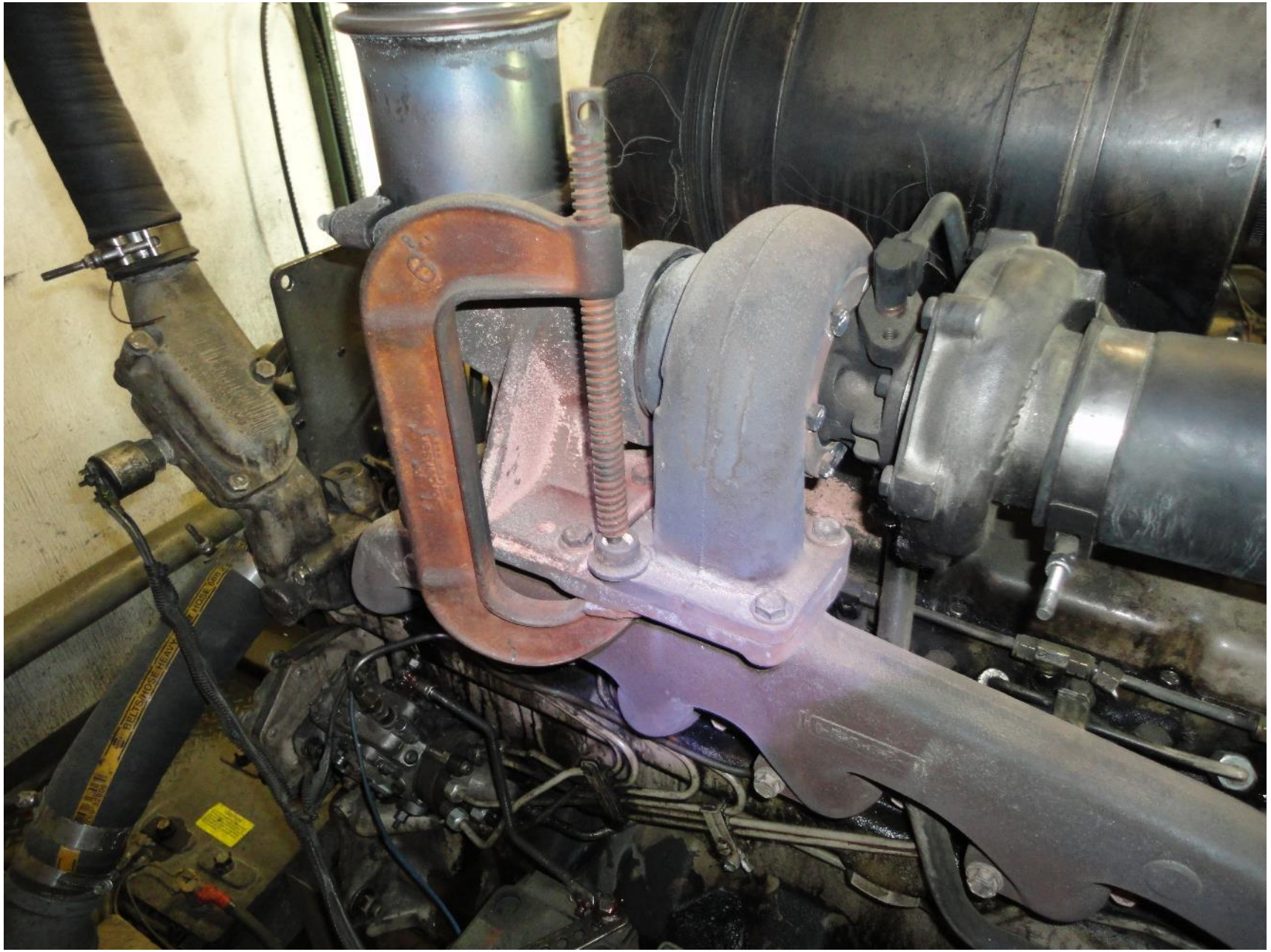
Gallon of Fuel Allocation for Diesel Generation by the Old Rule of Thumb



Diesel Generator Energy Outputs

Gallon of Fuel Allocation for New Technology Diesel Generation





Basic Components of Heat Recovery System

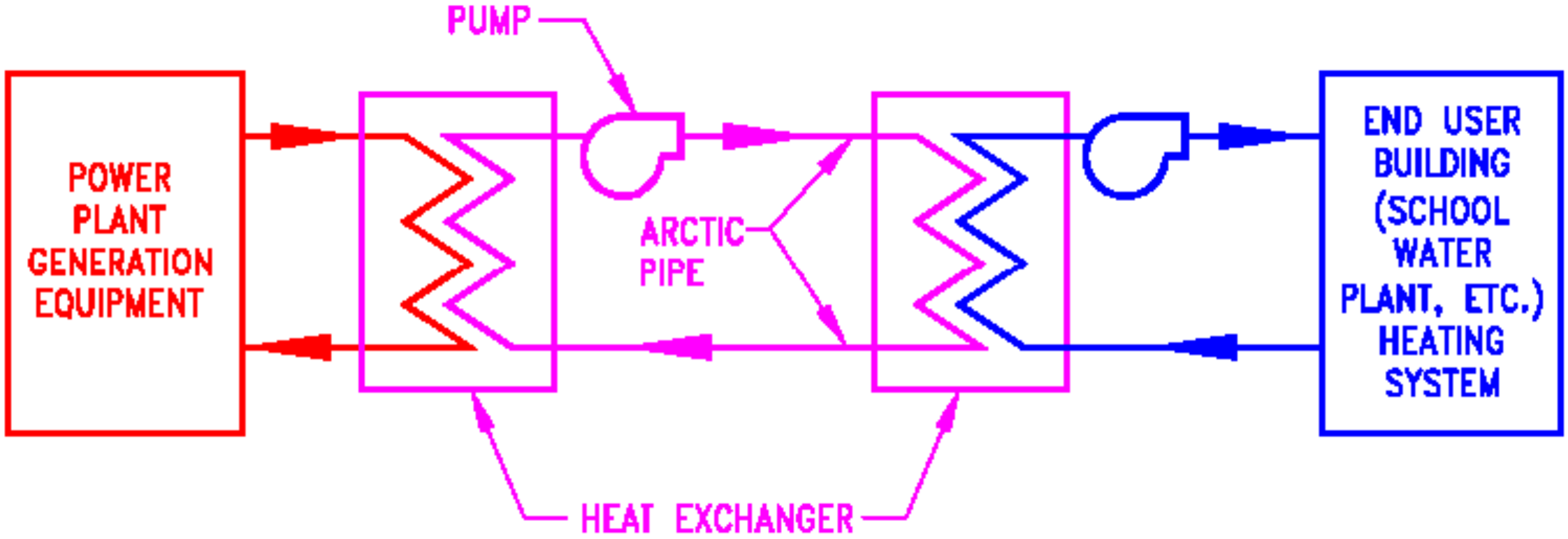


Plate & Frame Heat Exchanger



Brazed Plate Heat Exchanger





Power Plant Equipment



End User Bldg Equipment



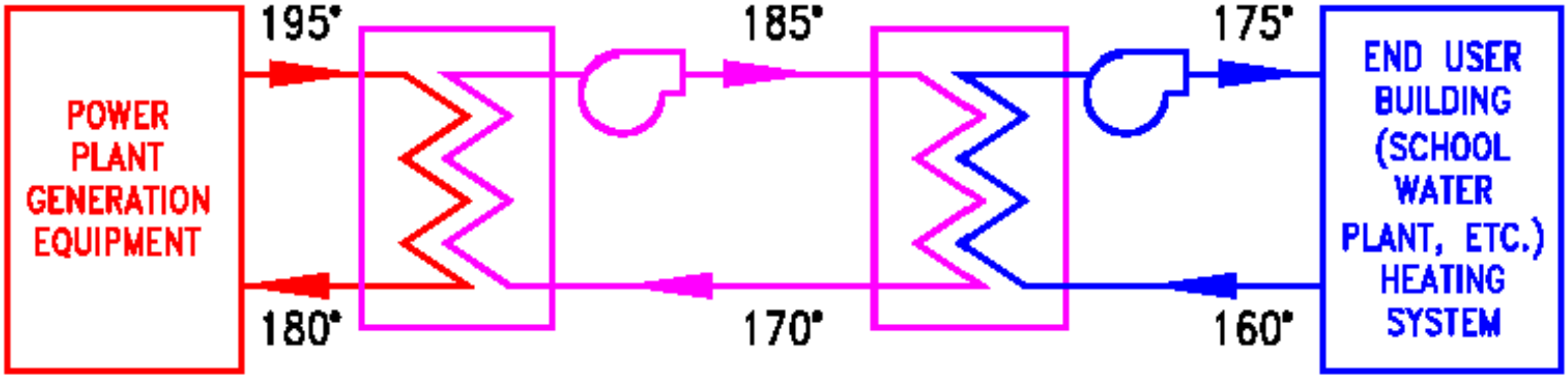
Steel Arctic Pipe



PEX (Plastic) Arctic Pipe



Normal Desired Operating Temperatures





Do You Call an Electrician or Plumber?

Capturing Heat for Alternative Energy Sources



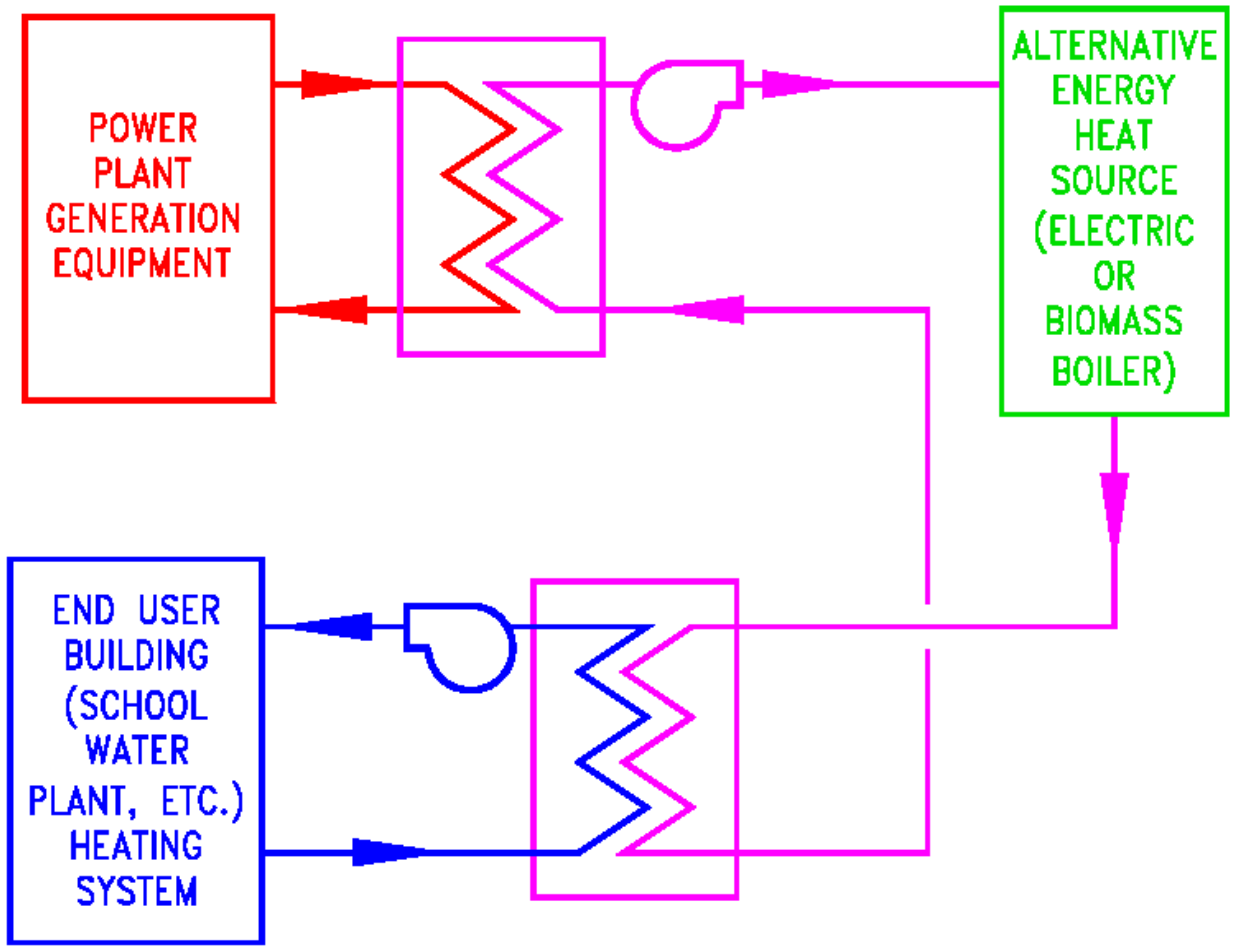
Electric Boilers with Heat Recovery

- Both wind and hydro systems use electric heat for frequency control, put it to use
- High wind power can exceed grid load and can be dumped into electric heat
- Run of river hydro power – use or lose (water spills over impoundment)
- Diesel heat recovery available decreases when electric power is offset with alternative energy

Biomass Boilers with Heat Recovery

- Use biomass to supplement diesel heat recovery
- Can offset day/night and season variations in recovered heat from diesel

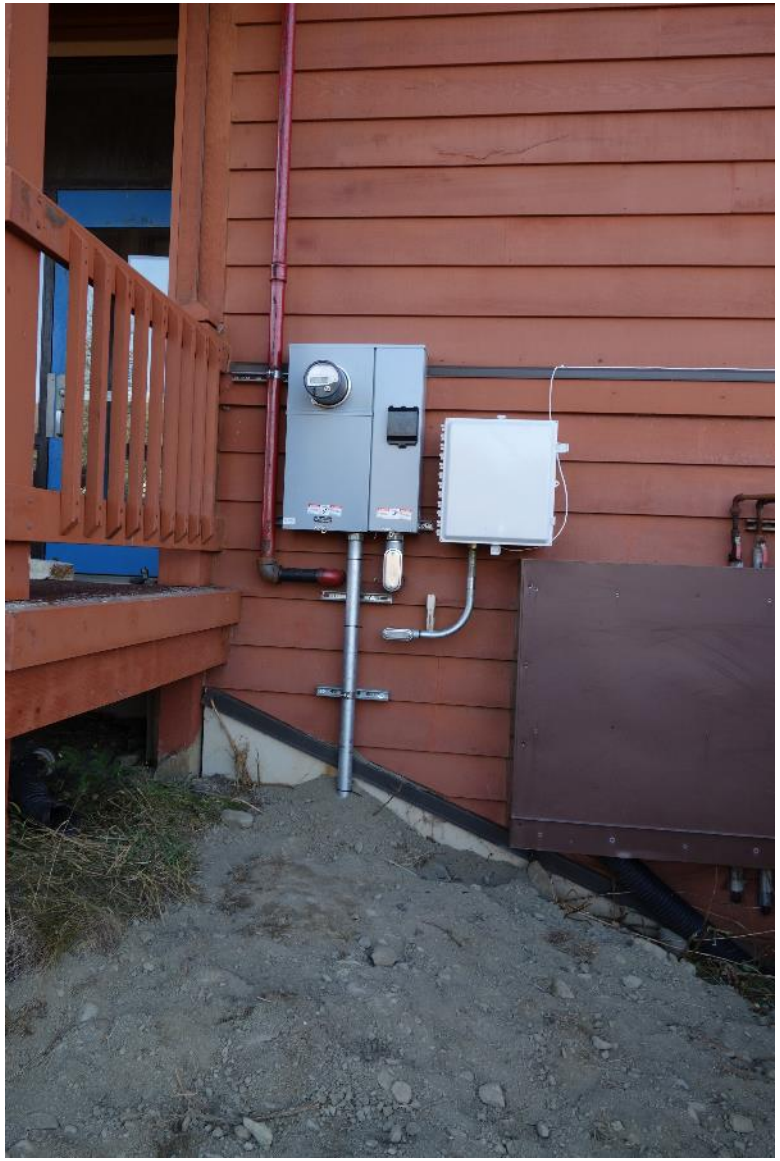
Heat Recovery with Alternative Heat Source




Chromalox




BOILER CONTROL
49.62
60.00
CONTROLLED BY
SWITCH
Flow
CP
#3
kitchen

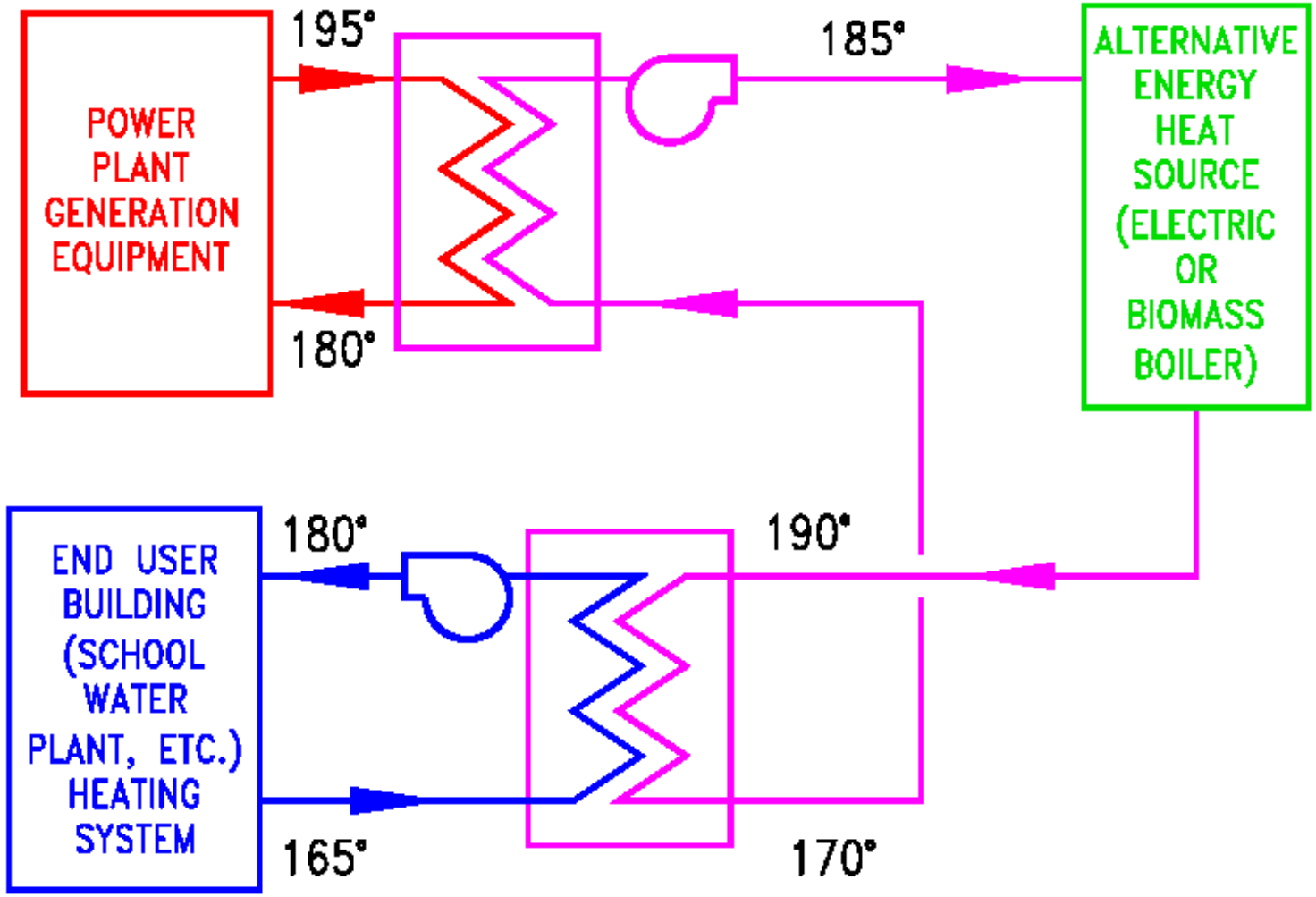


What do you do when you walking down the road and encounter this sign?




BEAR WARNING
NO PEDESTRIANS BEYOND THIS POINT
MOTOR VEHICLES ONLY

Potential Operating Temperatures



Benefits of Integrating Alternative Energy with Heat Recovery

- Increased fuel savings
- Higher heat delivery temperature
- Reduced pumping energy needed
- Smaller pumps and piping

Potential Limitations to Consider

- Higher temperatures may not work with PEX (plastic) arctic pipe systems

Typical PEX Arctic Pipe







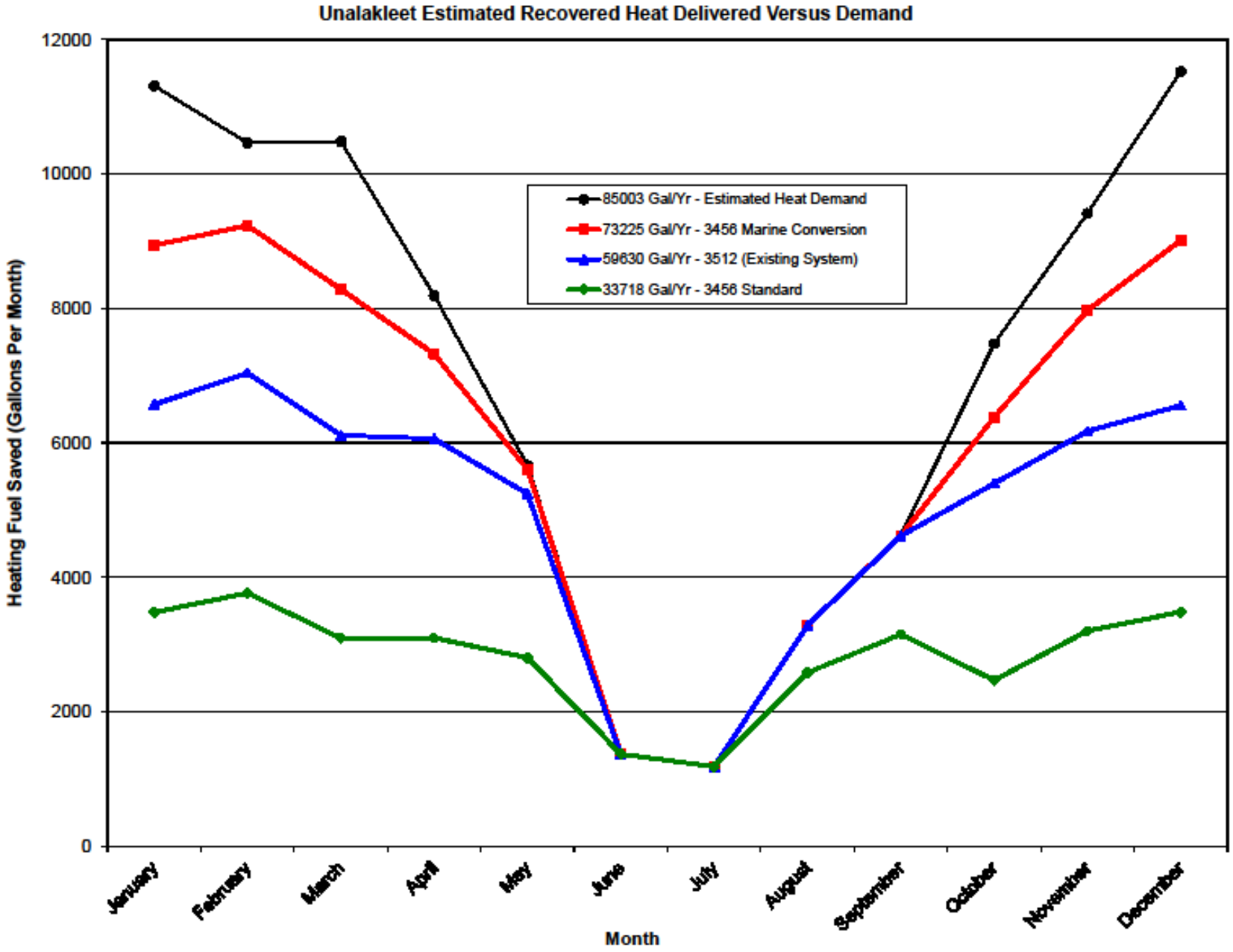


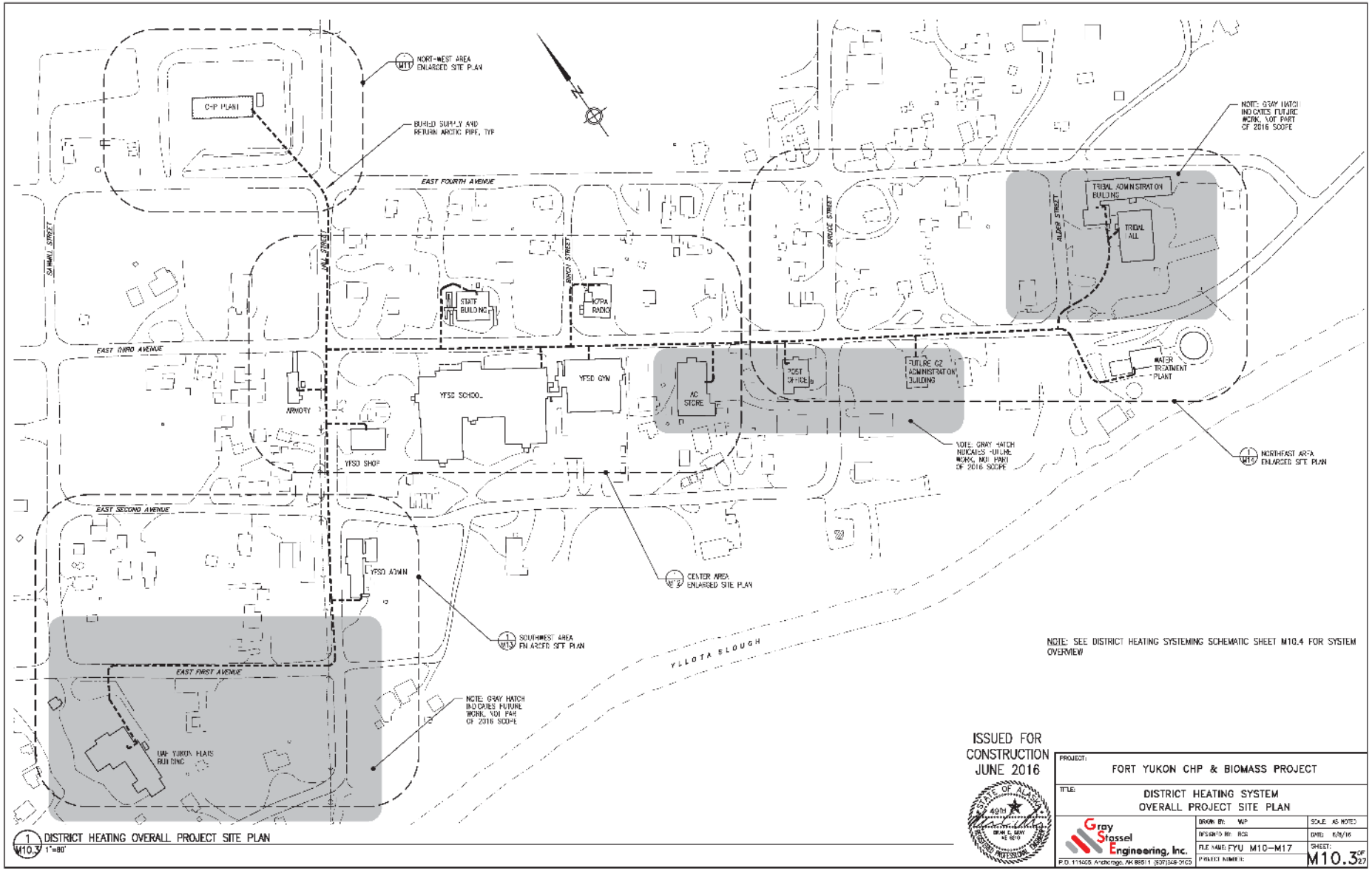
Optimize Utilization of Alternative Energy Heat Sources

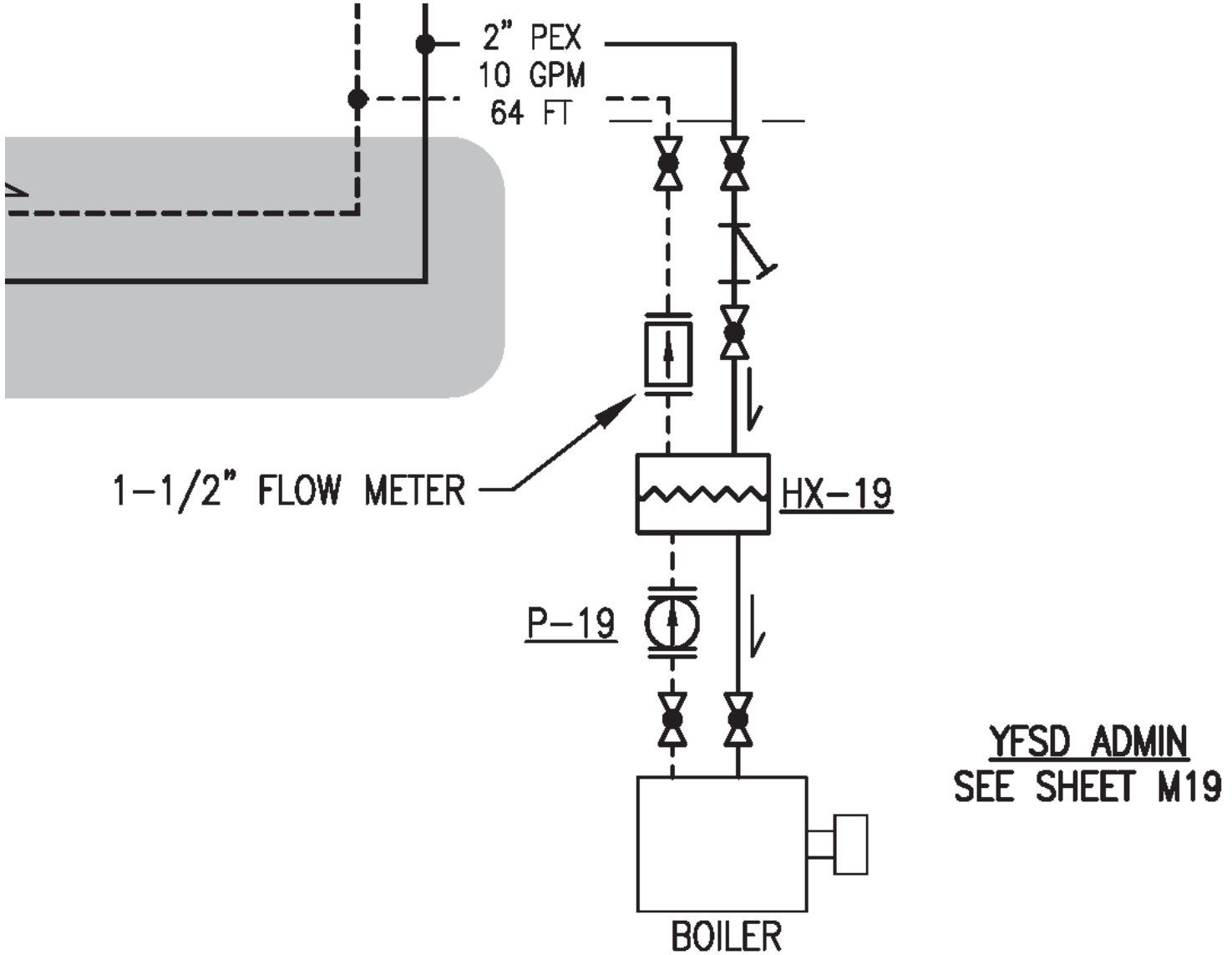
- Large connected heat loads
- Sequence loads if possible, low temp systems down stream of high temp
- Large fluid volume, thermal storage
- Coordinate controls with feed back, reduce heat output as load drops

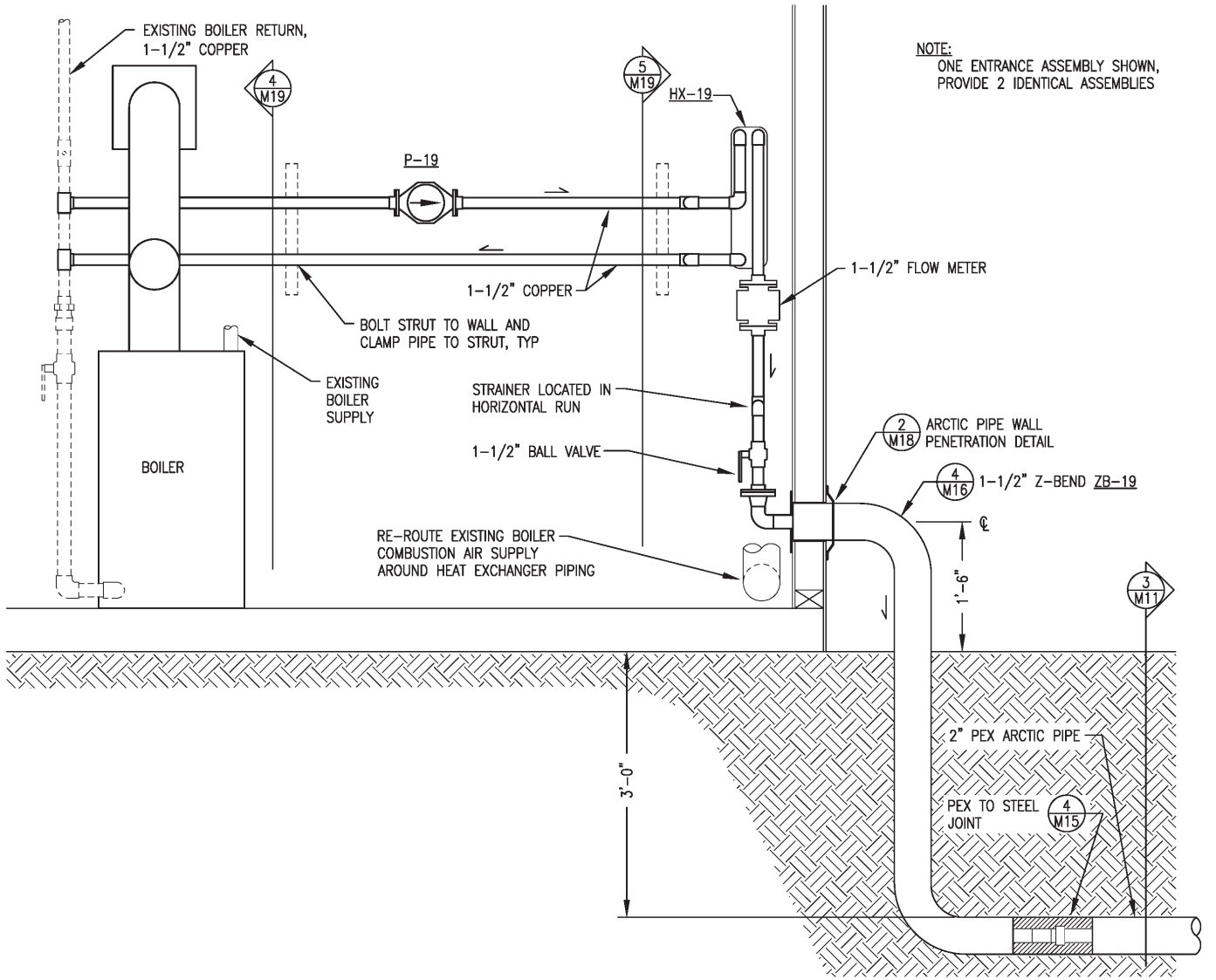
Plan for Successful Project

- Locate source close to heat loads
- Electric boilers can be installed far from alternative energy source
- Model system, available diesel heat and heat from alternative source
- Design a coordinated system to maximize utilization of available energy
- Use proven concepts and equipment
- Make as simple as possible

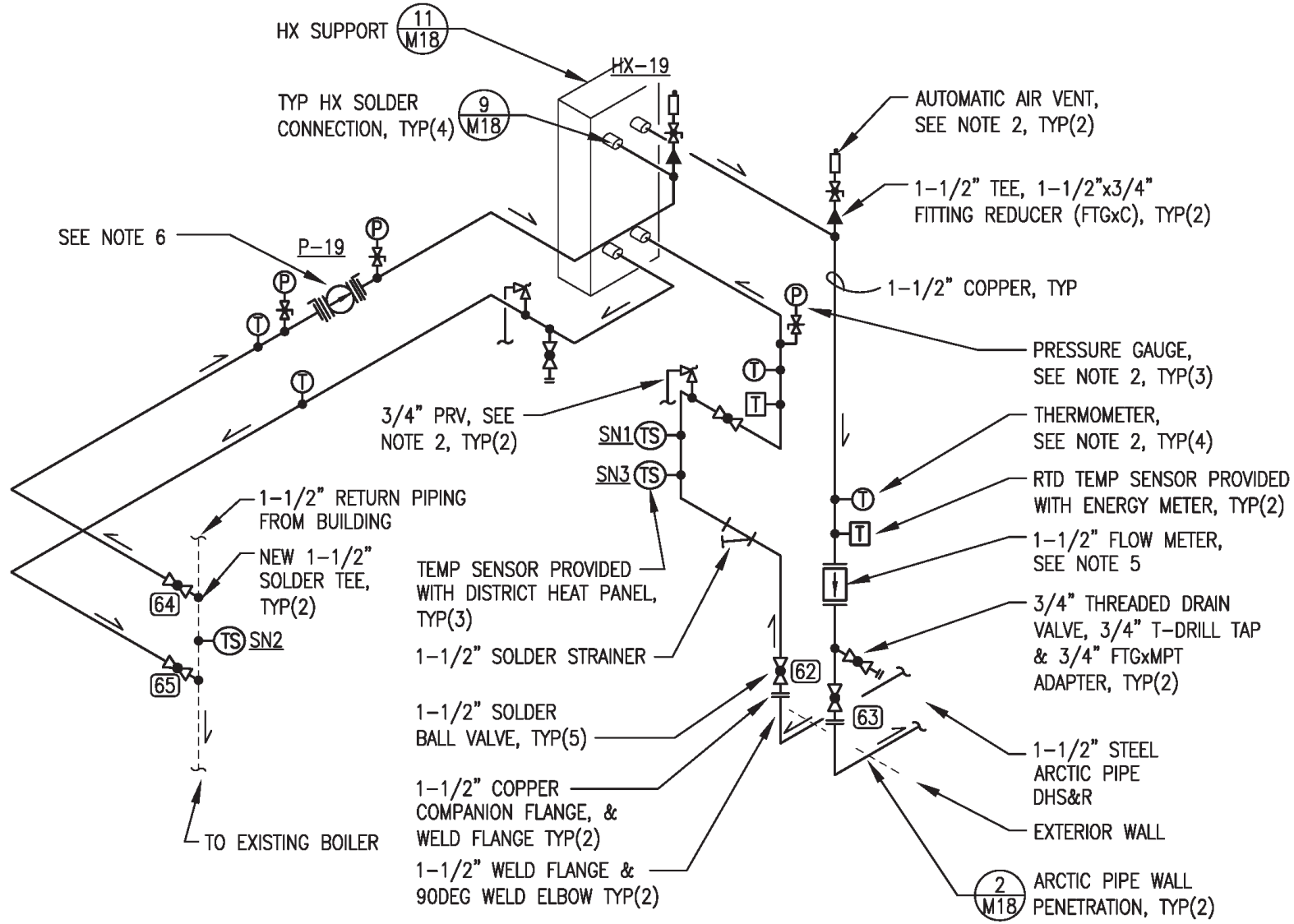

Unalakleet Estimated Recovered Heat Delivered Versus Demand
Heating Fuel Saved (Gallons Per Month)
12000
10000
8000
6000
4000
2000
0
85003 Gal/Yr - Estimated Heat Demand
73225 Gal/Yr - 3456 Marine Conversion
59630 Gal/Yr - 3512 (Existing System)
33718 Gal/Yr - 3456 Standard
January
February
March
April
May
June
July
August
September
October
November
December
Month


NORTH-WEST AREA ENLARGED SITE PLAN
CHP PLANT
BURIED SUPPLY AND RETURN ARCTIC PIPE, TYP
EAST FOURTH AVENUE
SCHOOL STREET
JAN STREET
BIRCH STREET
SPRUCE STREET
ALDER STREET
STATE BUILDING
KOYA RADIO
EAST THIRD AVENUE
ARMORY
YFSD SCHOOL
YFSD GYM
YFSD SHOP
AC STORE
POST OFFICE
FUTURE GZ ADMINISTRATION BUILDING
TRIBAL ADMINISTRATION BUILDING
TRIBAL HALL
WATER TREATMENT PLANT
NOTE: GRAY HATCH INDICATES FUTURE WORK, NOT PART OF 2016 SCOPE
NORTHEAST AREA ENLARGED SITE PLAN
CENTER AREA ENLARGED SITE PLAN
EAST SECOND AVENUE
YFSD ADMIN
SOUTHWEST AREA ENLARGED SITE PLAN
YUKON FLATS BUILDING
EAST FIRST AVENUE
YUKON SLOUGH
NOTE: SEE DISTRICT HEATING SYSTEMING SCHEMATIC SHEET M10.4 FOR SYSTEM OVERVIEW
ISSUED FOR CONSTRUCTION JUNE 2016
PROJECT: FORT YUKON CHP & BIOMASS PROJECT
TITLE: DISTRICT HEATING SYSTEM OVERALL PROJECT SITE PLAN
Gray Stassel Engineering, Inc.
SCALE: AS NOTED
DATE: 6/8/16
FILE NAME: FYU M10-M17
SHEET: M10.3 OF 27
1 M10.3 DISTRICT HEATING OVERALL PROJECT SITE PLAN 1"=80'


2" PEX
10 GPM
64 FT
1-1/2" FLOW METER
HX-19
P-19
BOILER
YFSD ADMIN
SEE SHEET M19



2 M19 YKSD ADMIN BUILDING ENTRANCE SECTION VIEW
1" = 1-0"



3 M19 YKSD ADMIN ISOMETRIC PIPING DIAGRAM

NO SCALE

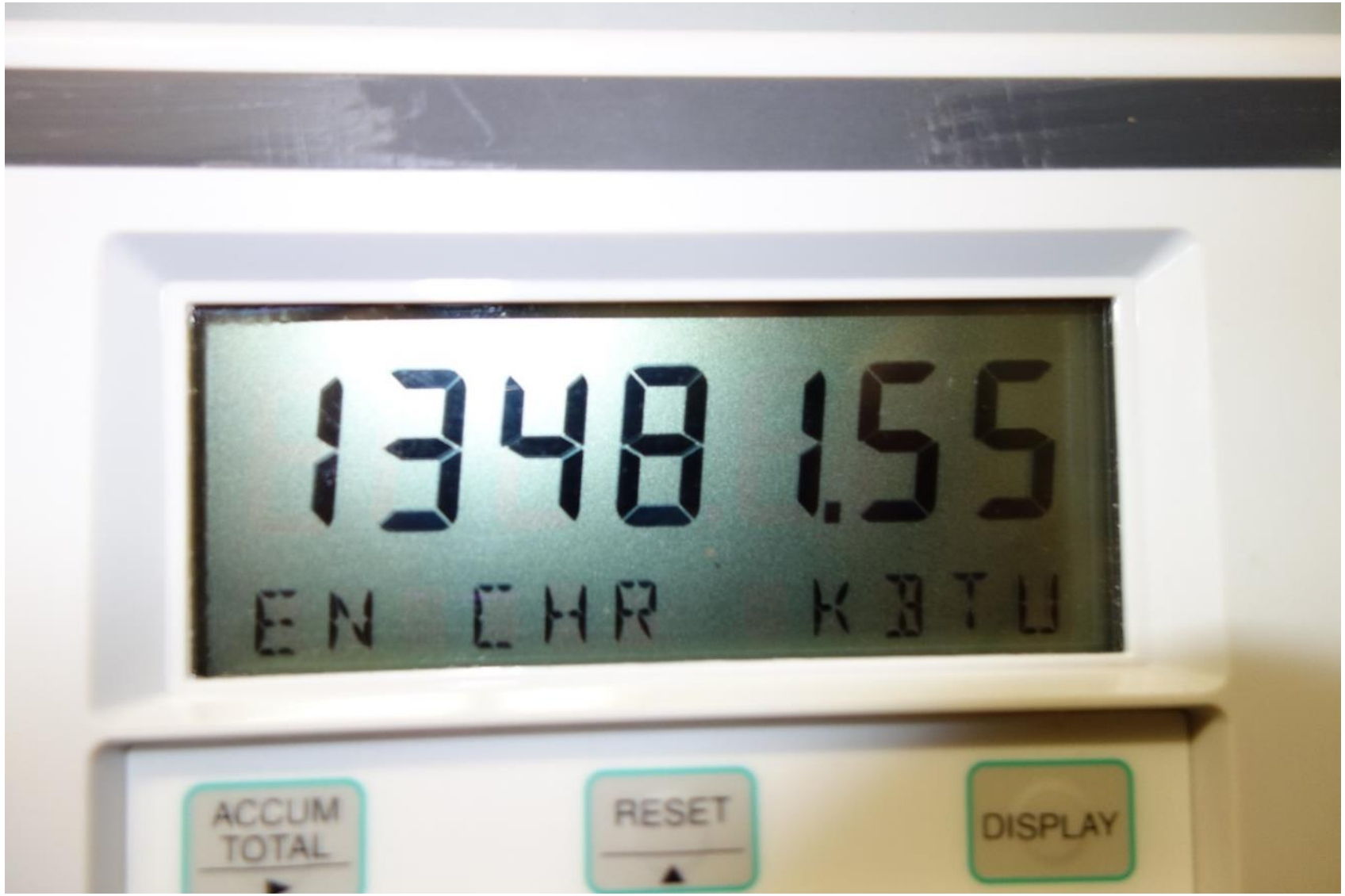



NORMALLY OPEN, BUILDING HEATING RETURN
NORMALLY OPEN, BUILDING HEATING SUPPLY


AMTROL
THERM-X-TROL




DISTRICT HEAT PANEL
CONTROL POWER ON
PUMP RUNNING
DISTRICT HEAT DISCHARGE LOCKOUT
DISTRICT HEAT LOW TEMP LOCKOUT
CONTROLLED POWER, INC.


1348 1.55
EN CHR KBTU
ACCUM TOTAL
RESET
DISPLAY



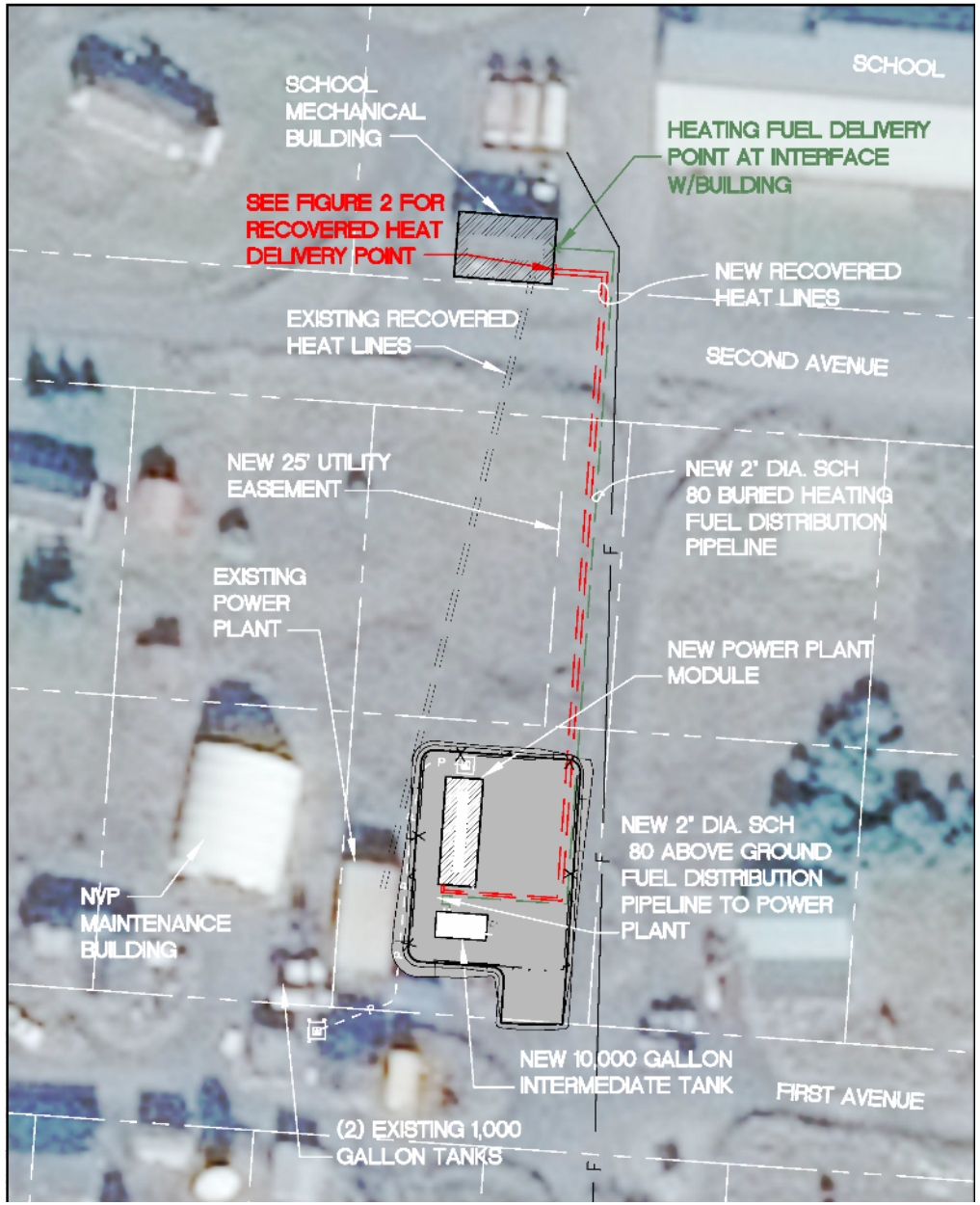


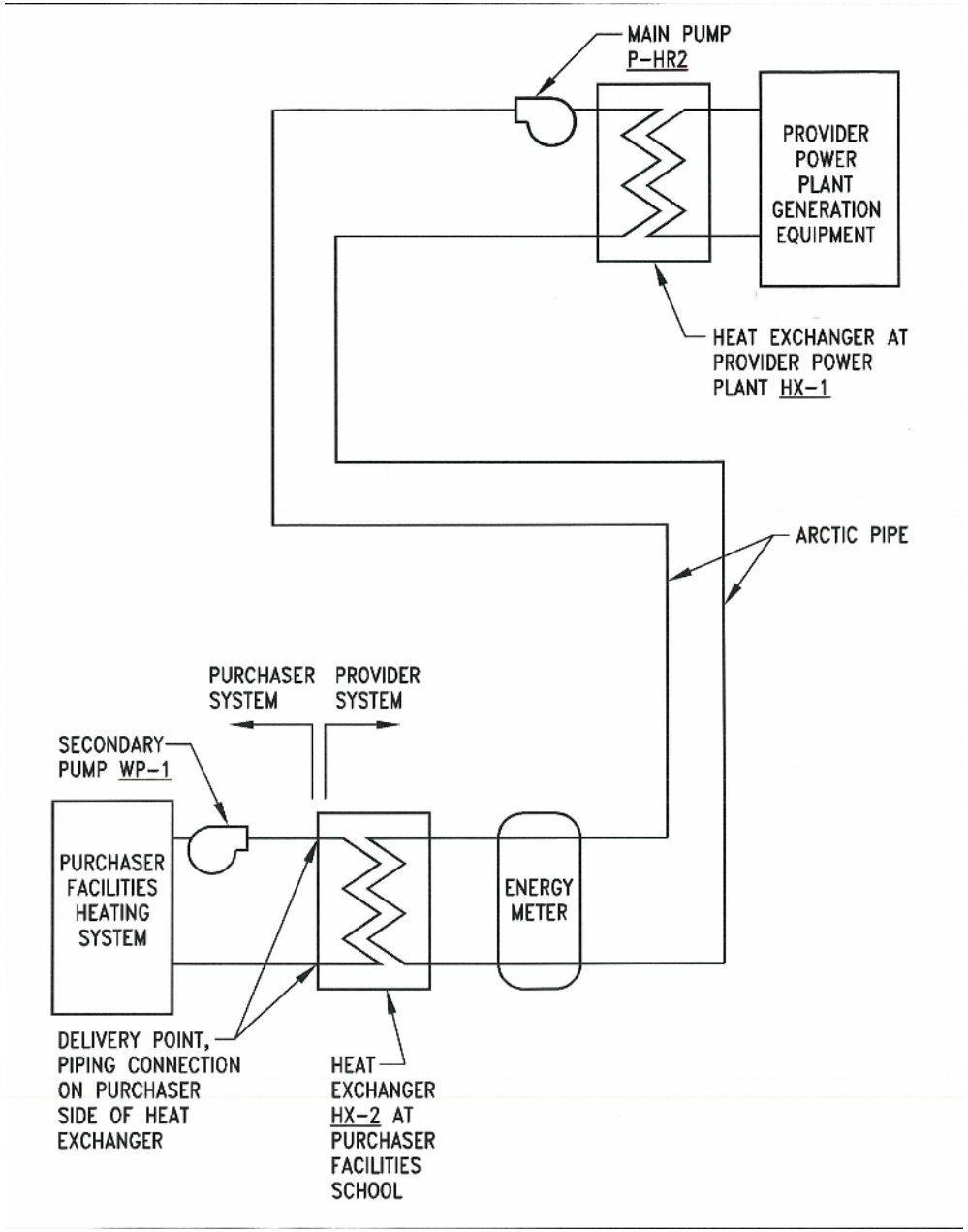




Heat Sales Agreements

- Summary and intent of the agreement
- Definitions & acronyms
- Length of time of agreement
- Exit clauses
- Description of system including sketches
- Operations and maintenance system, provider typically covers
- Payments
- Amount, typically 50 to 75% of the purchaser's avoided cost of diesel fuel
- BTU meter required and it location in system important to understand
- Gallon of fuel equivalency to number of BTU's


SCHOOL
SCHOOL MECHANICAL BUILDING
HEATING FUEL DELIVERY POINT AT INTERFACE W/BUILDING
SEE FIGURE 2 FOR RECOVERED HEAT DELIVERY POINT
NEW RECOVERED HEAT LINES
EXISTING RECOVERED HEAT LINES
SECOND AVENUE
NEW 25' UTILITY EASEMENT
NEW 2" DIA. SCH 80 BURIED HEATING FUEL DISTRIBUTION PIPELINE
EXISTING POWER PLANT
NEW POWER PLANT MODULE
NEW 2" DIA. SCH 80 ABOVE GROUND FUEL DISTRIBUTION PIPELINE TO POWER PLANT
NVP MAINTENANCE BUILDING
NEW 10,000 GALLON INTERMEDIATE TANK
FIRST AVENUE
(2) EXISTING 1,000 GALLON TANKS

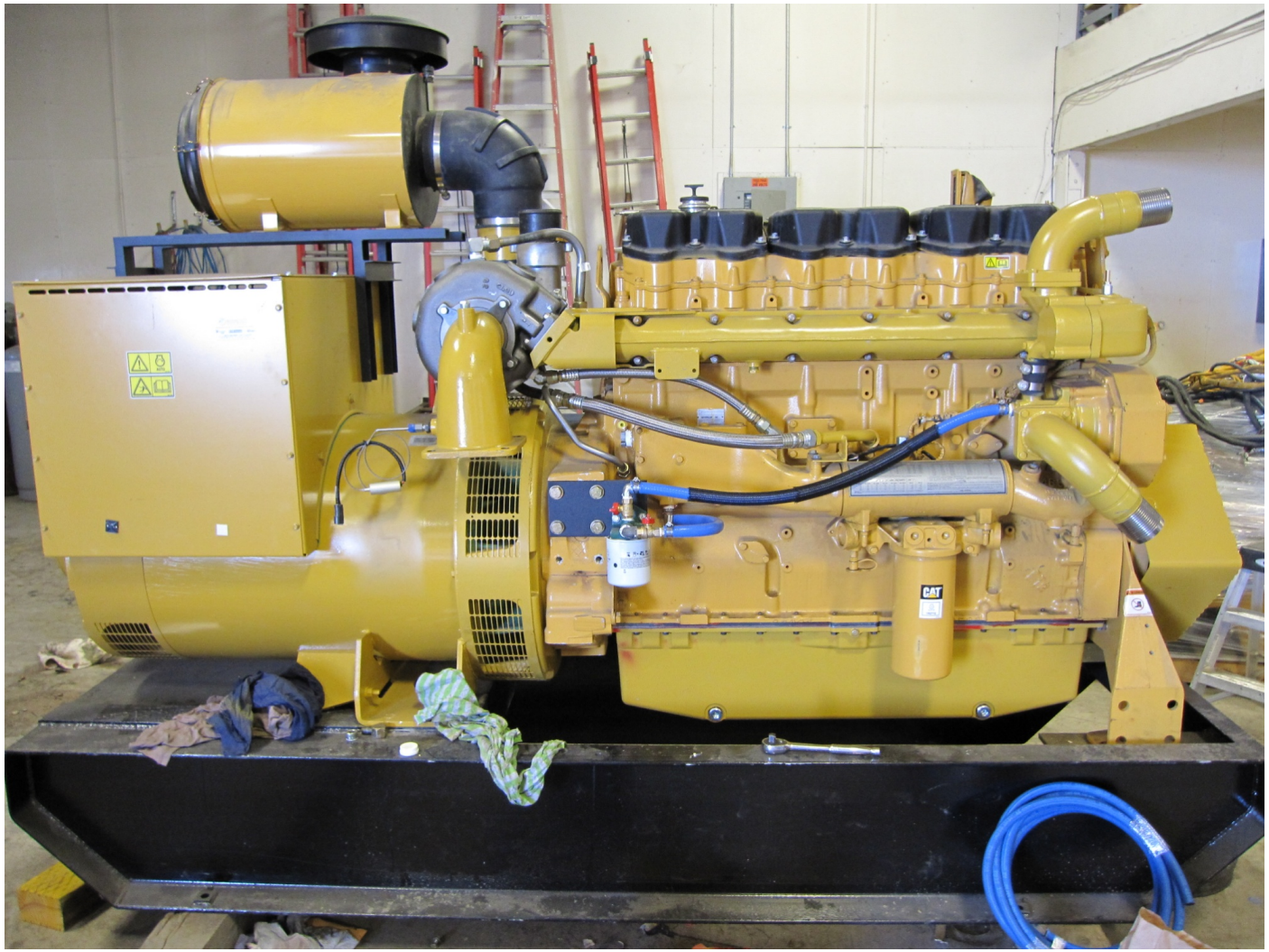

MAIN PUMP
P-HR2
PROVIDER POWER PLANT GENERATION EQUIPMENT
HEAT EXCHANGER AT PROVIDER POWER PLANT HX-1
ARCTIC PIPE
PURCHASER SYSTEM
PROVIDER SYSTEM
SECONDARY PUMP WP-1
PURCHASER FACILITIES HEATING SYSTEM
ENERGY METER
DELIVERY POINT, PIPING CONNECTION ON PURCHASER SIDE OF HEAT EXCHANGER
HEAT EXCHANGER HX-2 AT PURCHASER FACILITIES SCHOOL

Heat Sales Agreement Sample

CAT 3456 Typical Exhaust Manifold



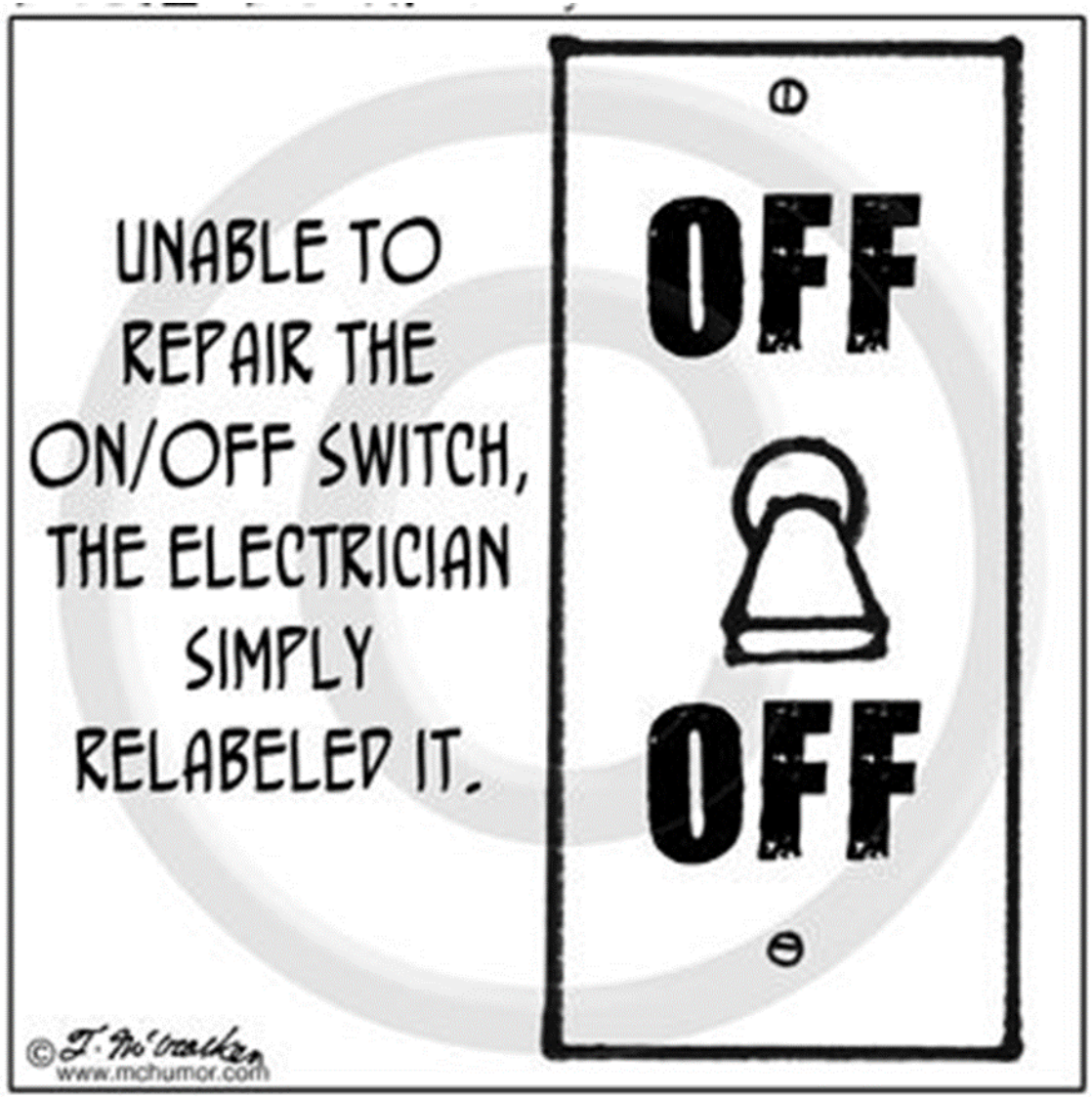
CAT 3456 Marinized Manifold



Optimized Diesel Engine Heat Recovery

- Standard CAT 3456 = 17,300 gallon/yr of potential heating fuel savings
- Marine Conversion 3456 = 29,300 gallon/yr of potential heating fuel savings
- Fuel Savings = 12,000 gallons/yr
- Fuel at $4.50/gallon = $54,000/yr


GIT
-R-
DONE
DVD


UNABLE TO REPAIR THE ON/OFF SWITCH, THE ELECTRICIAN SIMPLY RELABELED IT.
OFF
OFF
www.mchumor.com



"Man, I got the Only-A-Half-Hour-For-Lunch-And-The-Salmon-Ain't-Jumping Blues."

Why Do Transformers Hum?

Because they Don't Know the Words!





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