

2 x Mariah 60/30 Heat PlusPower CHP

Inuvik, Northwest Territories
Canada

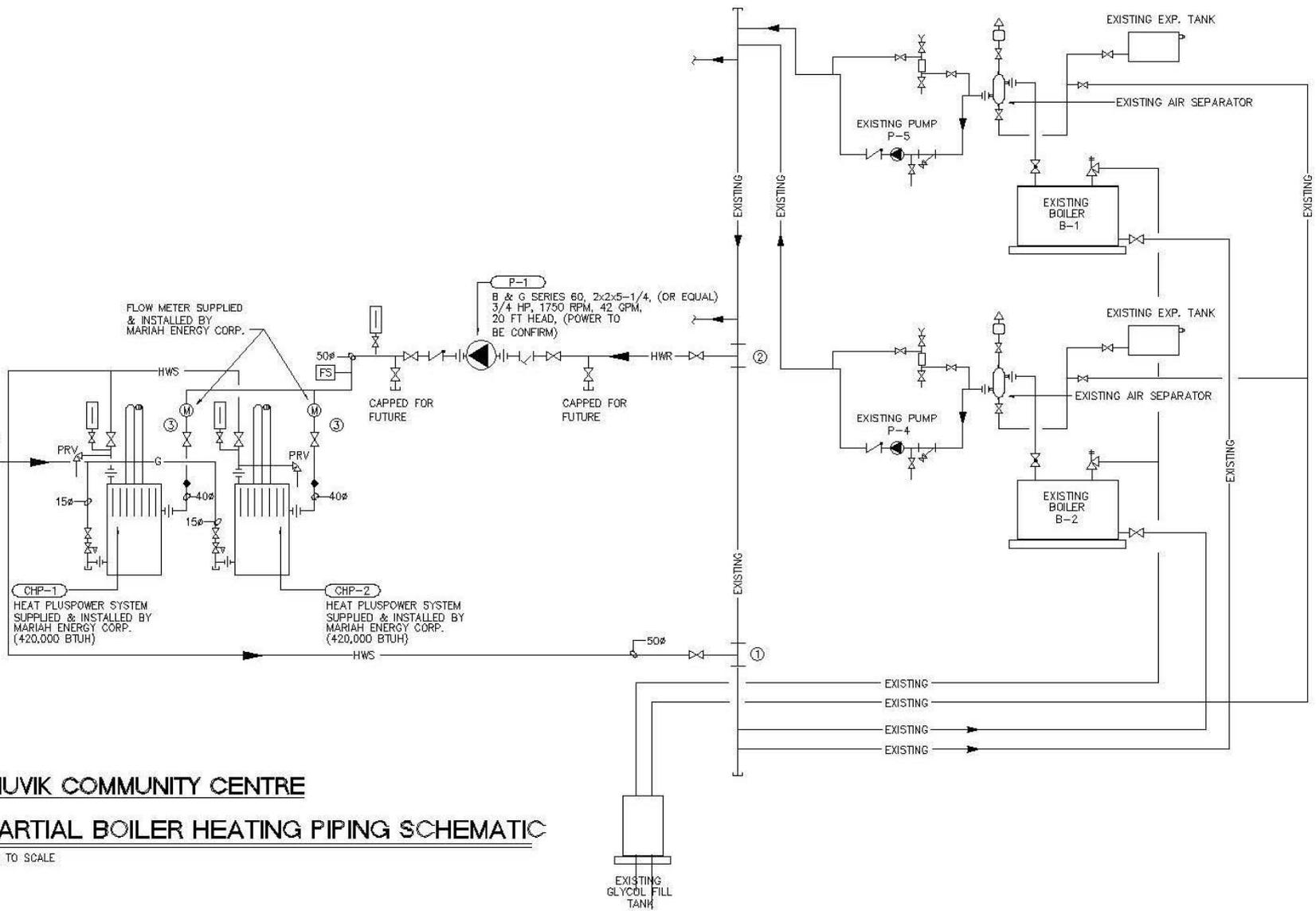
Myra J. Berrub,
Northwest Territories Power
Corporation

Organisation

- Project Manager: Gerd Sandrock, P.Eng.
- Funding Partners: Natural Resources Canada
- Engineer: Keen Engineering
- Project Plan Vs Actual dates

	Plan	Actual
– Equipment Delivery	Jul 2002	Aug 2002
– System Commissioned	Sep 2002	Sep 2002
– Monitoring Underway	Oct 2002	Oct 2002

- ① CONNECT NEW 50# HWS TO EXISTING.
- ② CONNECT NEW 50# HWR TO EXISTING.
- ③ WATER METER TO BE INSTALLED IN A STRAIGHT RUN OF PIPE MIN. 15" UPSTREAM OF PUMP (P-1) & 7.5" DOWNSTREAM OF CHP UNIT



INUVIK COMMUNITY CENTRE
PARTIAL BOILER HEATING PIPING SCHEMATIC

NOT TO SCALE



Figure 1: 2 x 60/30 Heat PlusPower Units



Figure 2: Exhaust Ducting from Turbine to Heat Exchanger

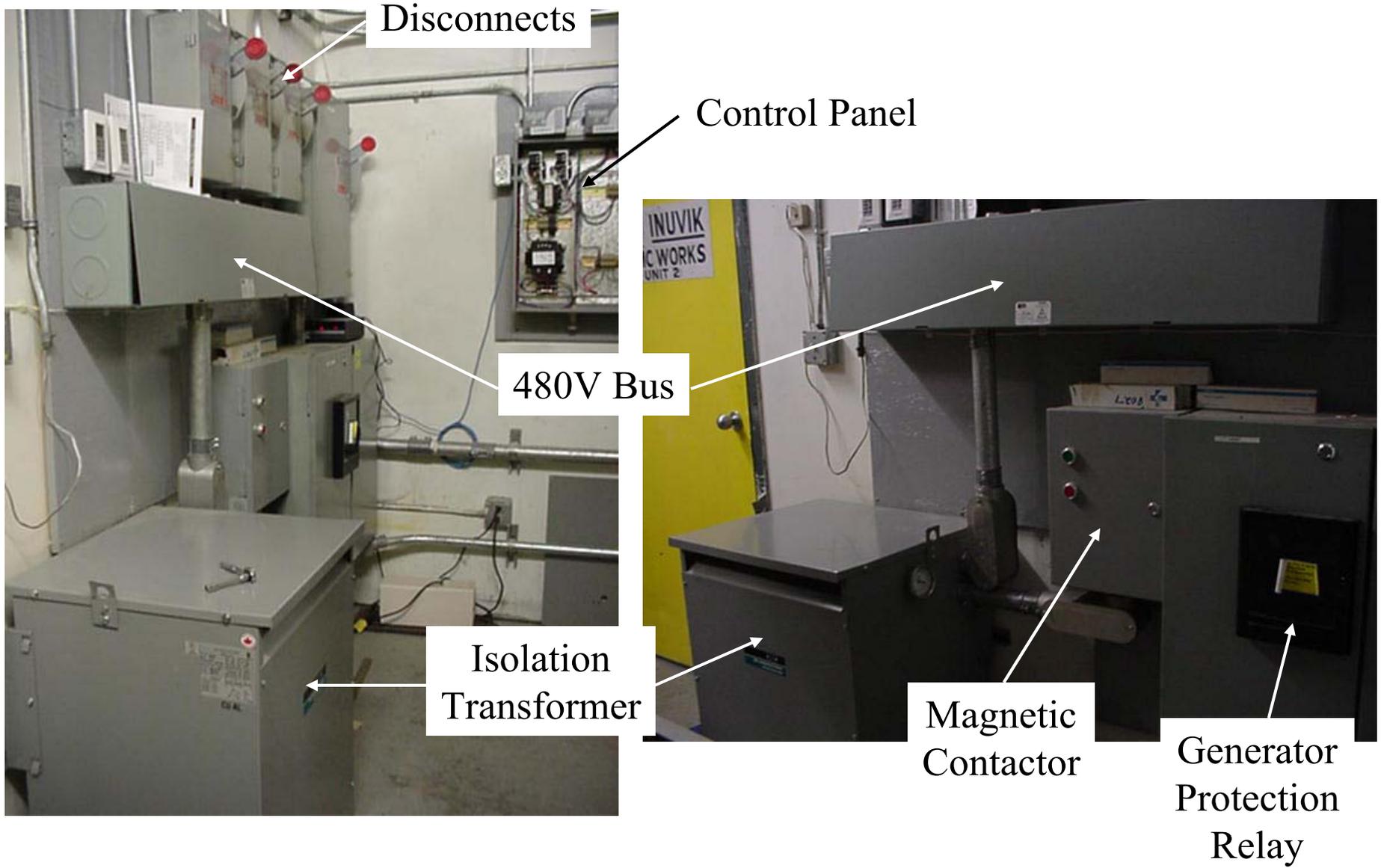


Figure 3: Switch Gear

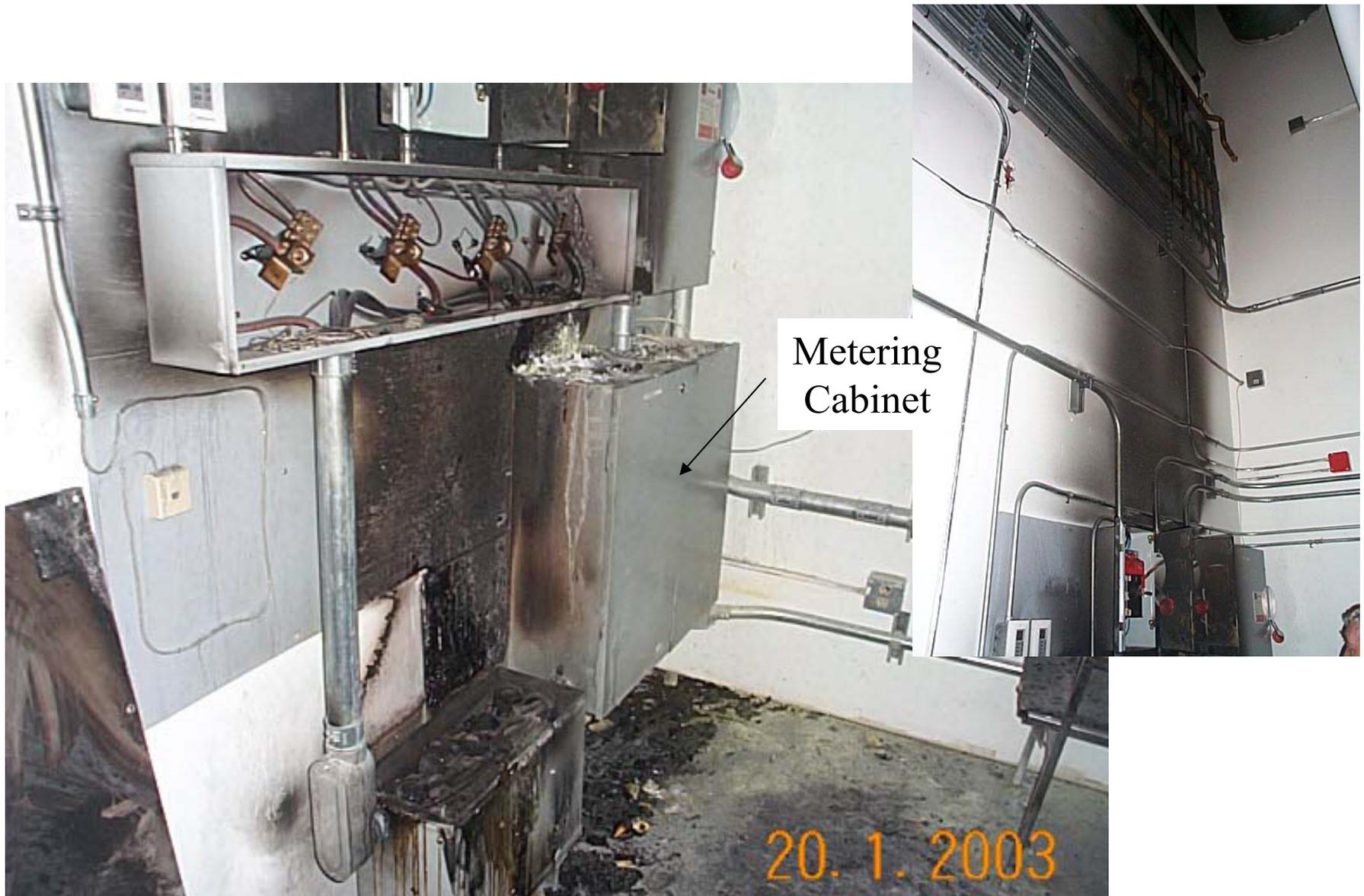


Fig. 4: Fire Damage



Cable modem



Disconnects



Transformer



480V Bus
(CT's melted)



Metering Cabinet

Fig. 4b: Fire Damage cont'd

Cost Table in US\$

Item	Actual	100% Hindsight	50 th * Installation
Turbine	2 x \$36,500	2 x \$36,500	2 x \$36,500
CHP unit	2 x \$11,500	2 x \$11,500	2 x \$11,500
Mechanical			
Electrical			
Civil			
Consulting Engineering Project Mangement	** \$108,700	\$87,000	\$87,000
NTPC Costs	\$7,100 + Additional costs due to deficient installation \$x?***	\$5,680	\$5,680
TOTAL	\$211,800 +\$x	\$188,680	\$188,680

Currency: \$1.3CAD/USD

* Target Cost

** Turn-Key Installation

*** Additional Costs TBD

Electrical Performance

- Hours of operation to December 31 2003:
 - Unit #1: 5,049 h
 - Unit #2: 4,973 h
- Average Electrical Performance:
 - Power Delivered to Load/LHV Fuel: 21%
- Estimated Parasitic Losses:
 - Compressors (2): 2 x 2 kW
 - Pump: 425 Watts
 - Transformer: 120 Watts (estimate)
- Power Quality:
 - No Power Quality Tests Done

Thermal Performance

- Thermal Output:
 - Unit #1: 68 kW (0.232 MMBtu/hr)
 - Unit #2: 42 kW (0.143 MMBtu/hr)
- Average water Delta T across HX:
 - 6C (66C – 60C)
- Heat Exchanger Efficiency: 45%
- Expected Peak Total System Efficiency: 78%
- Actual Total System Efficiency:
 - (21% Electrical + 45% Thermal) = 66%

Emission Performance

- No emission testing done

O&M Performance

- Availability
 - Unit not available for 4 ½ months due to fire
 - Otherwise, excellent availability
- Current estimate of annual O&M costs excluding major hot end replacement:
 - US\$4,600 per year (as per supplier info)
 - 5c/kWh (as per supplier info)

Institutional Experience

- Approvals obtained:
 - Electrical inspector
 - Boiler inspector
- Additional cost to obtain approvals negligible
- No issues around electrical interconnection
 - Additional protection added since the fire

Supplier Support

- Adequacy of Technical Support:
 - Space and Hot Water Heating Expertise is lacking
 - CHP system was piped into secondary heating loop as per supplier drawings (turn-key installation)
 - Heat from CHP is not able to contribute to all loads
 - At times, redundant use of CHP and boiler
 - Controls Staff is Inexperienced
 - Overestimate ability to deliver
 - Internet-based monitoring is often down
- Supply and Costs of Spare parts:
 - Because Mariah is a Distributor who does not stock inventory, there is a Time Lag to Receiving Spare Parts

General Experience

- Areas needing improvement for future installations:
 - Engineer/supplier should have expertise in space and hot water heating
 - Remote monitoring package needs more testing before being sold commercially
- Future market opportunities in the North:
 - Diesel-fired microturbine
 - More work needs to be done in this area