



Mariah Energy Corp.
Clean Energy Solutions

Heat PlusPower™:

Applications & Economics

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Road Map

Mariah's Heat PlusPower™ Appliance

Applications

- Condominium DHW
- Liquid Fueled CHP Demonstration
- SAIT Swimming Pool

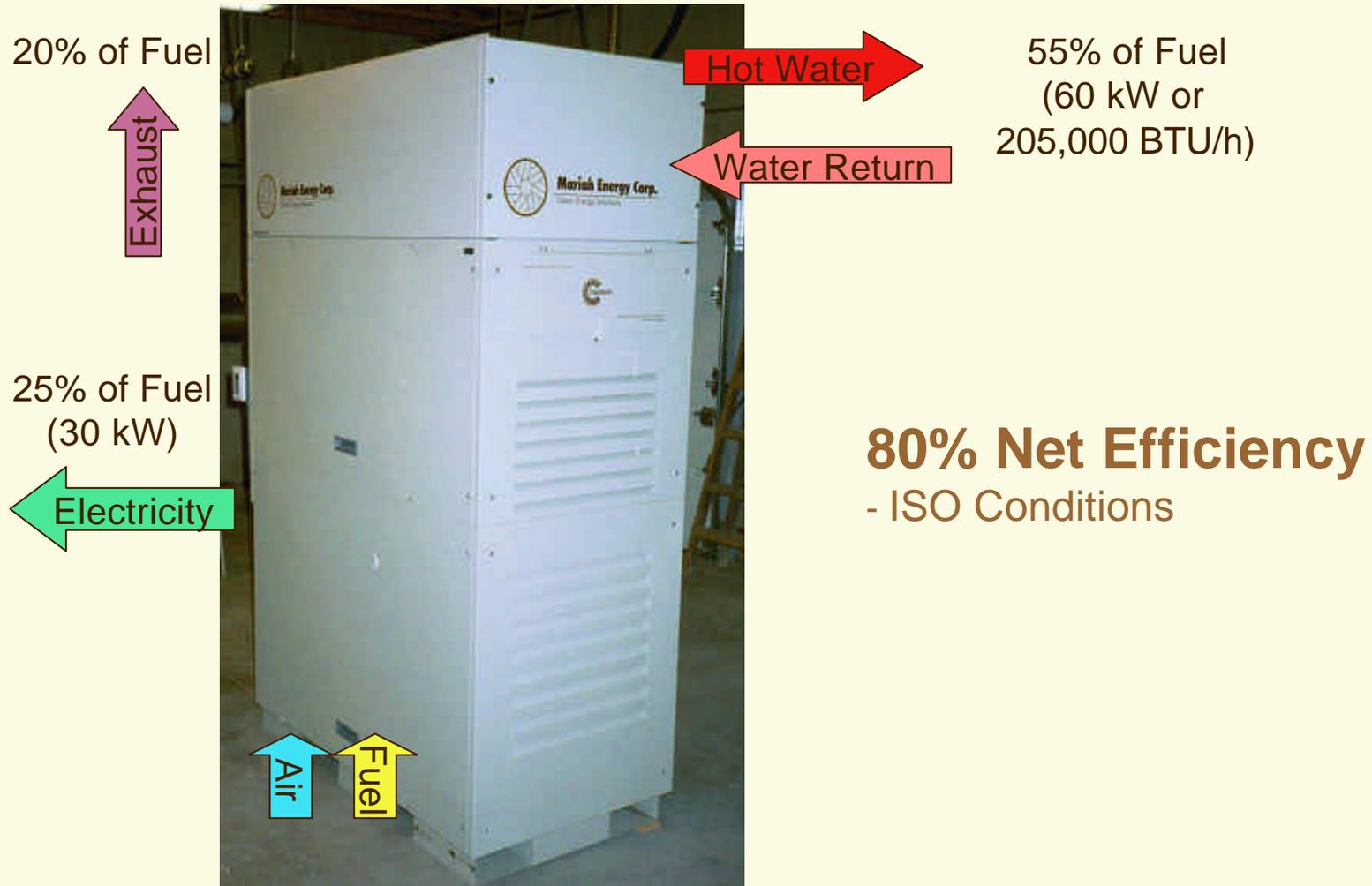
Economics

- Site Selection Criteria
- Economic Sensitivity

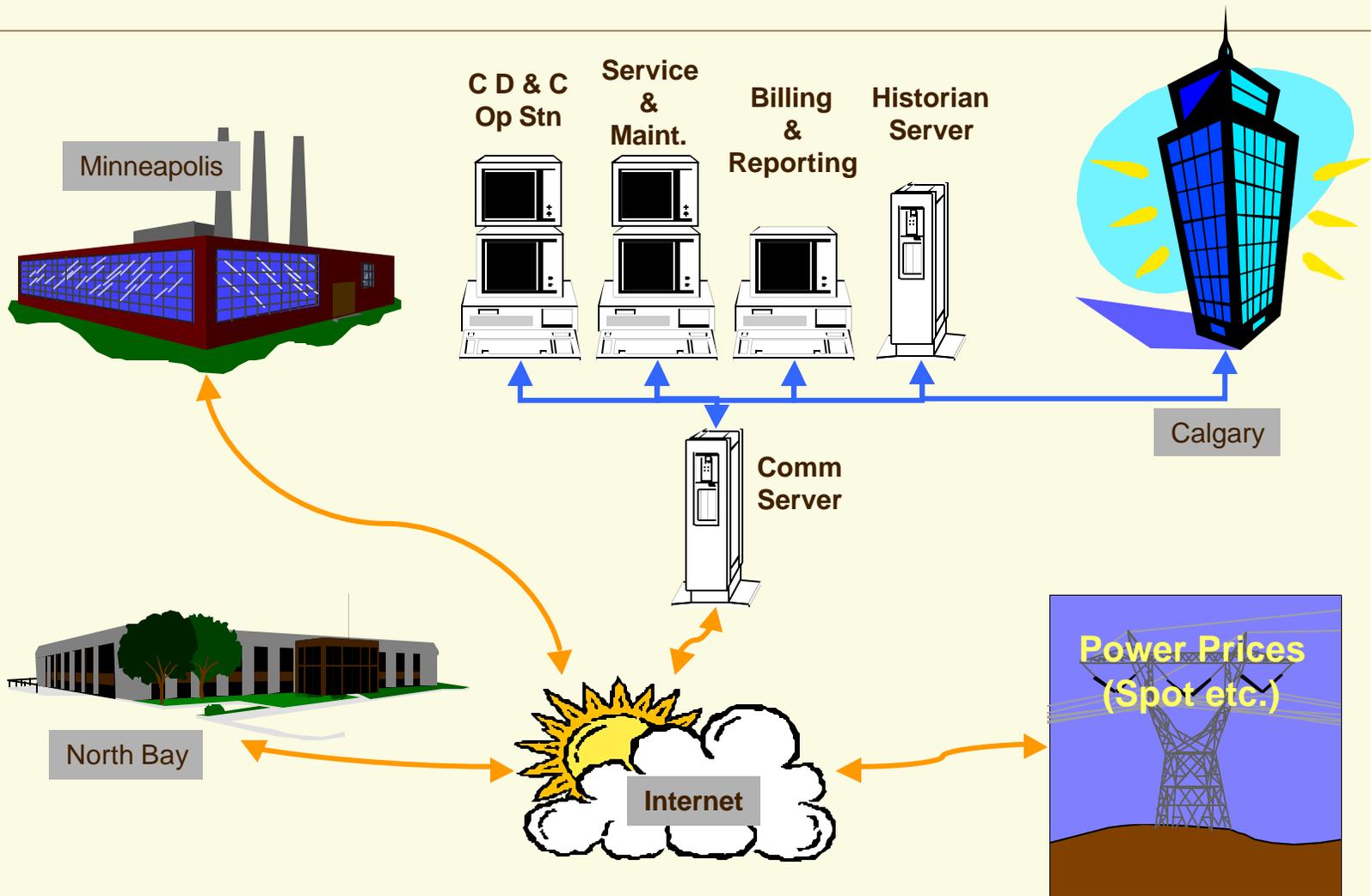
Acceptance of Electric Motor



60/30 Heat PlusPower™



Distributed Micro-Utility



Applications

- 📄 Condominium DHW - Walker Court
- 📄 College Swimming Pool - SAIT
- 📄 Liquid-Fuel Demonstration

Walker Court Condominium



Walker Court Mixed Use Condo

 Green Field Development

 12 Units, 2 Buildings (plus Common Garage)

 Each Unit Includes:

- Street-level Commercial space (with Basement)
- One or Two Residential Levels

Heating and DHW

Primary Loop: 150F - 200F

Radiant Floor Heating

Fan-coil Make-up Air

Primary Heat Source:
– 60/30 Heat PlusPower

Peaking Heat Source:
– Raypac Boiler
– Combi-Core dual-fired DHW tanks

Heat Utilization Metered

Domestic Hot Water

- Combi-Core
- Internal coil in each Module
- 75 Gal Modules (3 per building)

Long-term contract with condo to provide heat and power

>7000 hours operation

Electrical

- ☞ On-site generation primary source
- ☞ Grid peaking (grid parallel)
- ☞ Auto-transfer on grid failure
- ☞ Load shedding
- ☞ Individual unit metering (informational)
- ☞ Interconnection approved

SAIT College Pool



Southern Alberta Institute of Technology (SAIT)

- 📄 College swimming pool
- 📄 Approx. Olympic size
- 📄 2 x 60/30 Heat PlusPower systems
- 📄 Grid parallel at all times
- 📄 Thermal and electrical base-load
- 📄 Long-term energy supply contract

SAIT Challenges

📄 On-site compression required (20 psi gas available)

📄 Exhaust ventilation

- Long run

📄 Physical location in existing mechanical spaces

📄 Delivery access

📄 Access for training purposes

- Extra instrumentation
- Remote access to turbine
- Physical inspection

CanMET Liquid Fueled Test

📄 60/30 Heat
PlusPower w. Diesel
Fuel Option

📄 Test with #2 Heating
Oil

📄 Off-grid test with
periodic starts

📄 Challenges

- High sulfur content fuel
- Acid exhaust
- Condensation
- Stand-alone
 - Watch electrical loads
- Fuel pump
 - External fuel pressure when off

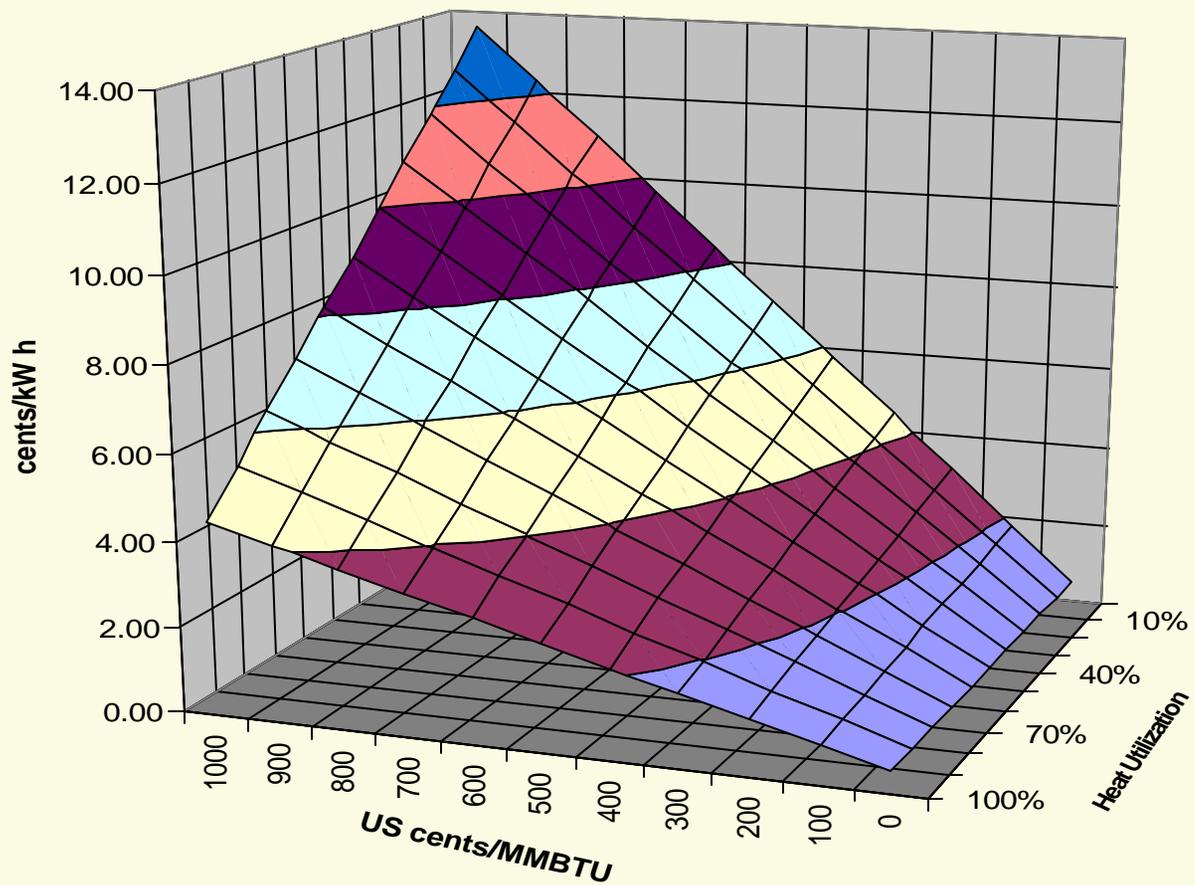
Liquid Fuel Pilot

- 📄 System transferred from CanMET to utility customer
- 📄 Now running on Diesel for a test period
- 📄 Q2 2002 will move to field installation

Economics (US funds)

- 📄 MCG as a simple generator:
 - \$57.50 /MW h at \$4 /MMBTU Gas
- 📄 Base-loaded CHP system:
 - \$21.10 /MW h MCG

Marginal Cost of Generation



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Value of CHP

$$\begin{aligned} V_{\text{CHP}} = & V_{\text{Power}} + V_{\text{Heat}} + V_{\text{Security}} + V_{\text{Emissions Reduction}} \\ & + V_{\text{T\&D Investment Deferral}} + V_{\text{Heating Eq. Investment Deferral}} \\ & + V_{\text{Fuel Efficiency}} + V_{\text{NV Fuel Destruction}} + \dots \end{aligned}$$

What makes a good host?

Year-round thermal load

- DHW (high density)
- Swimming pools
- Laundry facilities

Tolerate 'poorer' hosts if

- Power value high
- Emission reduction valued
- Power security valued

Nine Decades of Progress

Average Net Efficiency of Power Plants

- **1910:** ~65%
- **2000:** ~35%
- **2090:** ?