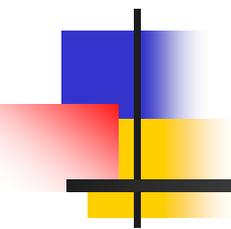


# Mariah CHP Installations

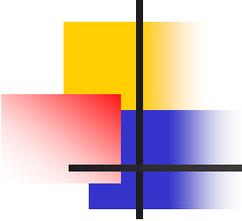
## Medicine Hat, Alberta

Presented by - Russ Smith  
City of Medicine Hat  
Microturbine Application Workshop  
January 21, 2004



# THE TECHNOLOGY

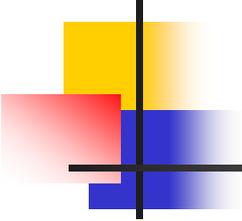
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# CAPSTONE TURBINE

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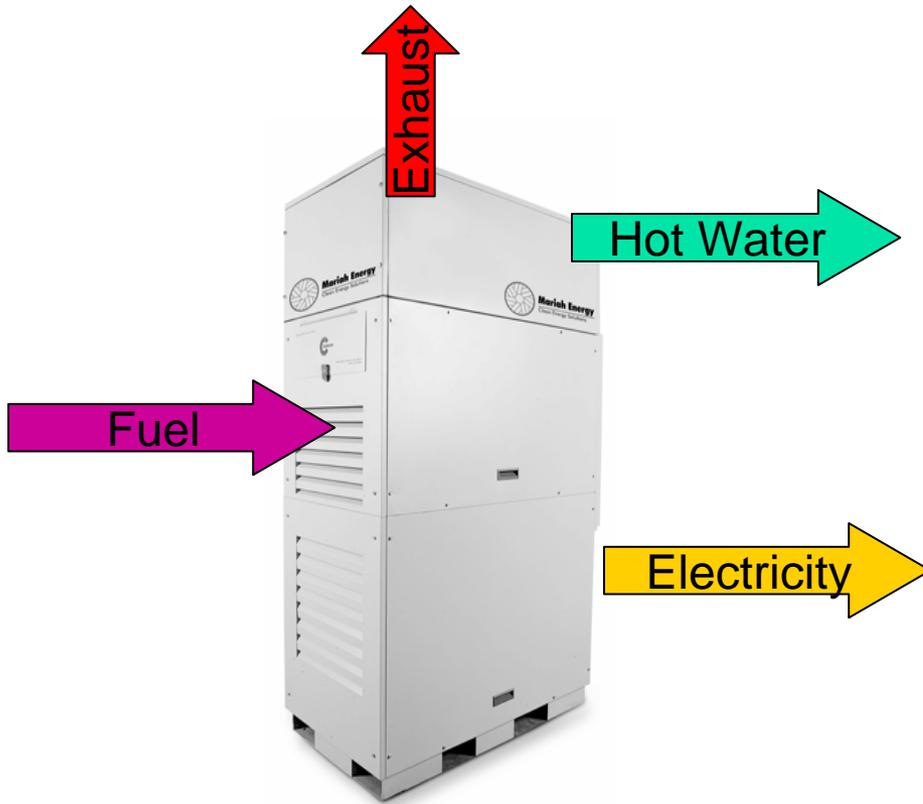
# + HEAT EXCHANGER

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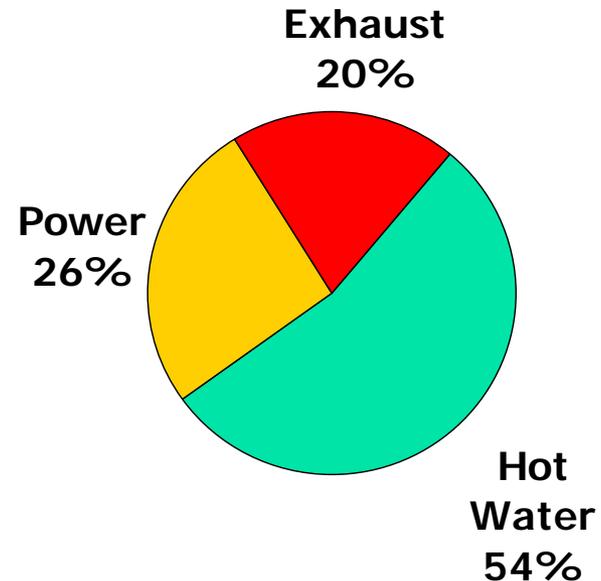


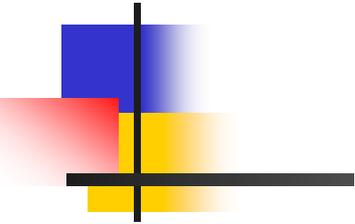
**Mariah Energy Corp. -  
Heat PlusPower System**

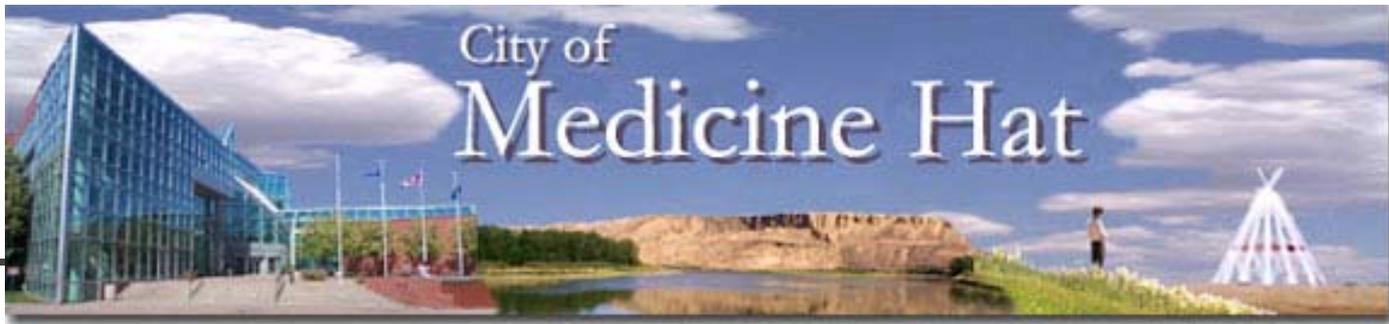
# Heat PlusPower System



80% Fuel Efficiency







## **Gas Utility**

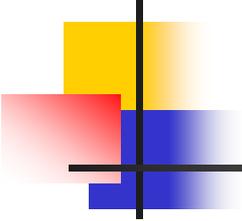
- Gas Production
- Gas Distribution

## **Electric Utility**

- Electric Generation
- Electric Distribution

## **Municipal Planning**

- Development permits

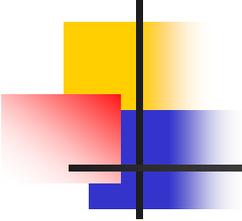


# MEDICINE HAT Advantage

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## **Comprehensive Service Provider:**

- Electrical Interconnection
- Gas Interconnection
- Gas Supply
- Installation Permits & Approvals



# THE RELATIONSHIP

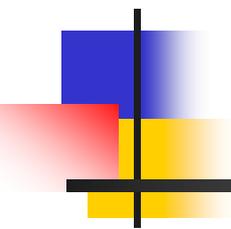
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## **Mariah Energy**

- Build / Own / Operate

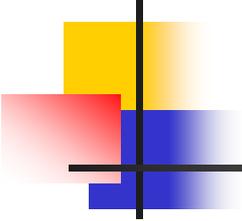
## **City of Medicine Hat**

- Provide Gas and Electric connections
- Sell Gas
- Purchase Power and/or heat



# THE PROJECTS

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# Suntec Greenhouse

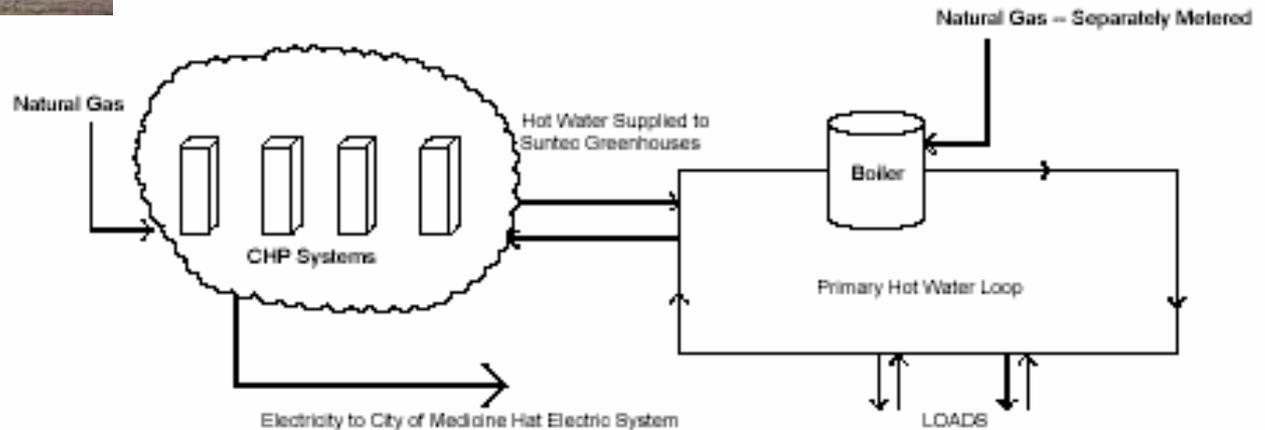
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- Mariah Builds-Owns-Operates
- 4 – 60/30 Heat PlusPower systems
- City buys power
- Greenhouse buys heat + exhaust

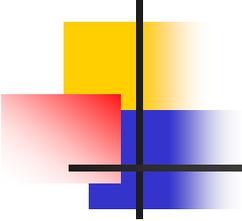
# Suntec Greenhouse



**Schematic of the Heat PlusPower System Integration at Suntec Greenhouses**



Four natural gas fired 60/30 Heat PlusPower™ systems provide Suntec Greenhouse with hot water. Excess electricity is sold back to the City of Medicine Hat's Electrical System.

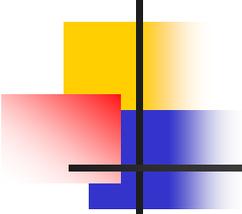


# Suntec Greenhouse

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## Cost Summary

CHP Units	\$193,900
Labour / Subtrades	<u>\$37,000</u>
TOTAL	\$230,900
Cost/kWh	\$1,925



# Suntec Greenhouse

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## Performance Summary (2003)

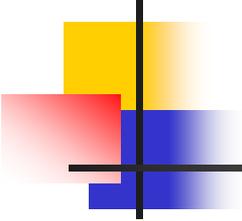
Hours of Operation (all units) - 11,892 hrs

Power Output - 240 MWH

Thermal Output (since May) – 1,035 GJ

Capacity Factor

- Electrical – 28%
- Thermal – 23%

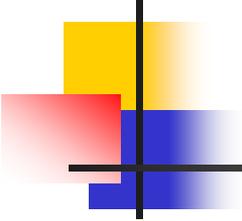


# Suntec Greenhouse

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## Technical / Installation Issues

- Turbine efficiency in the summer
- Software co-ordination
- Enclosure of units
  - Air flow
  - Heat associated failures



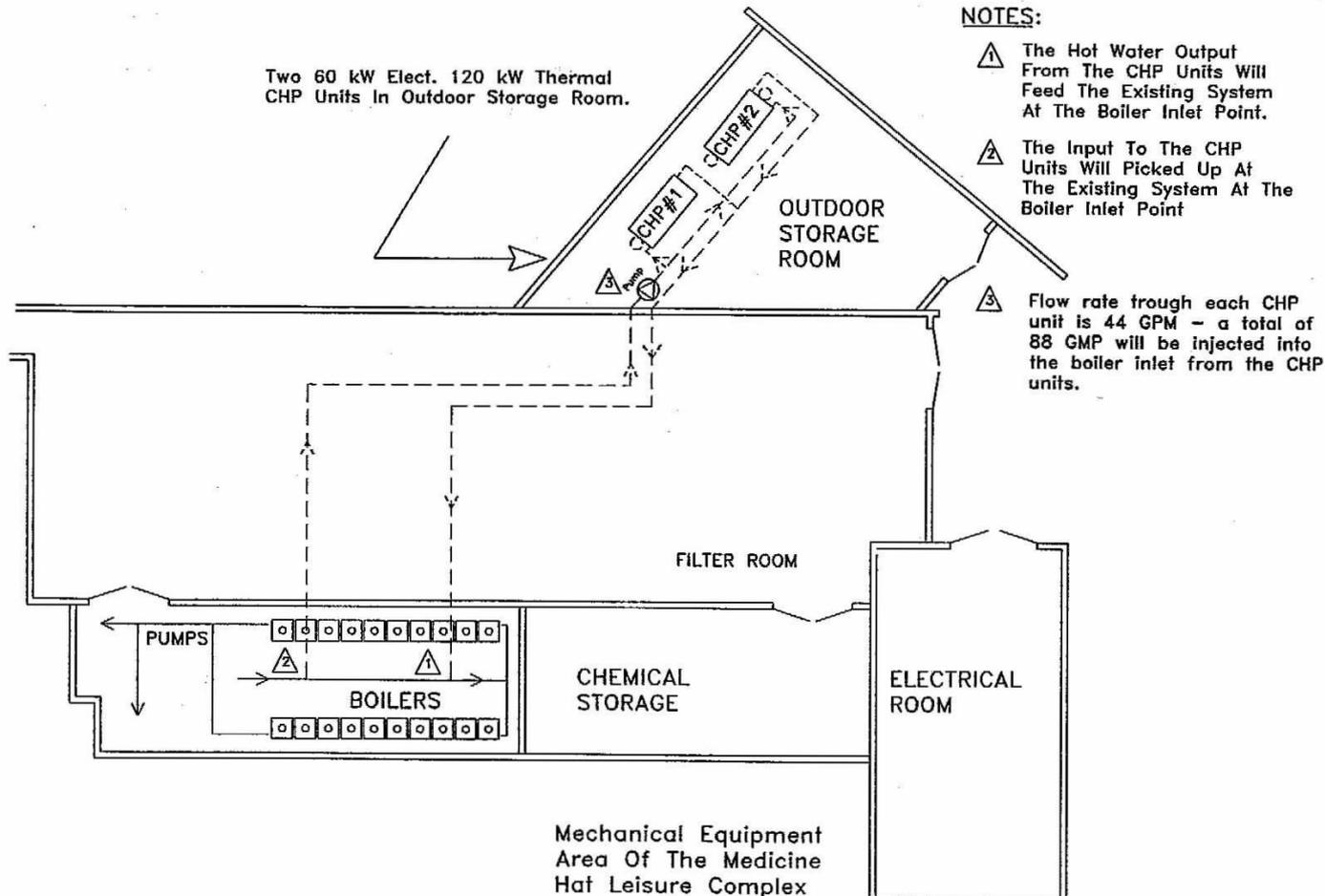
# Leisure Centre

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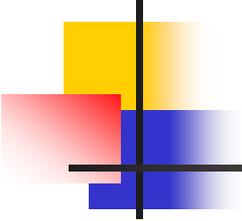
- Mariah Build-Own-Operate
- 2 – 120/60 Heat PlusPower systems
- City buys power + heat



# Leisure Centre



**NOTES:**  
 VERIFY ALL DIMENSIONS AND INFORMATION REPORTING ANY ERRORS AND DISCREPANCIES TO MARATH ENERGY CORP.  
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 THIS DESIGN AND THESE DRAWINGS MAY NOT BE REPRODUCED WITHOUT MARATH ENERGY CORP.'S PERMISSION



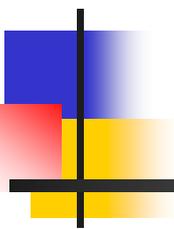
# Leisure Centre

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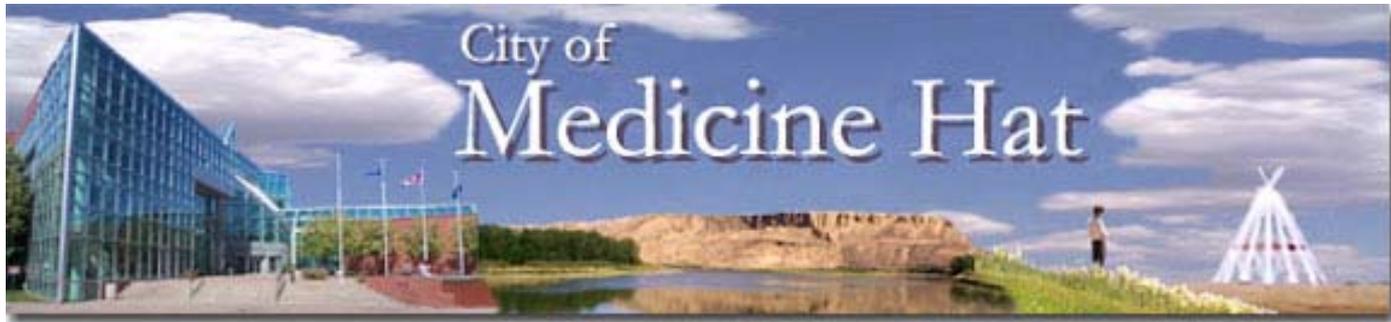
## Cost Summary

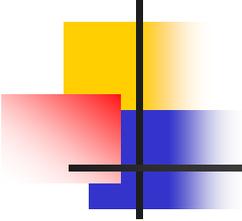
CHP Units	\$178,560
Labour / Subtrades	\$27,040
Material	<u>\$18,400</u>
TOTAL	\$222,400

Cost/kWh	\$1,850
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# THE CUSTOMER





# BENEFITS

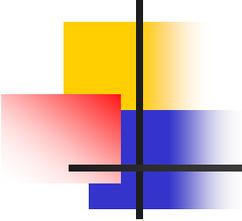
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## POWER

- Avoid Transmission / Distribution Costs
- Reduce Emissions

## HEAT

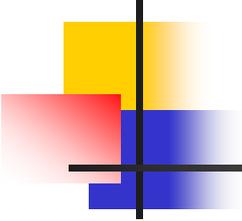
- Reduce Cost
- Reduce Emissions



# CONCERNS

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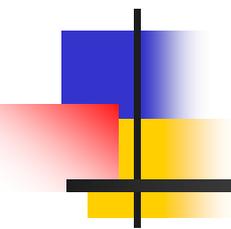
- Unit Reliability
- Sustainability



# KEY SUCCESS FACTORS

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- Cost of Delivered Power
- Reliability
- Emissions
- Interconnection



# QUESTIONS?

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