



Littleton/Englewood WWTP

Cogeneration Project

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BACKGROUND

- **Plant Energy Audit in 1996**
- **Heat needed for Anaerobic Digestion**
- **Recommended changes**
 - **300KW to 900KW output capacity**
 - **Lean burn**
 - **Co-fired, natural or methane gas**
 - **Higher efficiency engines**
 - **Variable output capability**

INSTALLATION COSTS

- **Installation and startup in 1999**
- **2 – 900KW Jenbacher Engines with GenSets cost approx. \$1.2M**
 - Turbo-charged and Leanox System
 - DIANE computer controller
- **Total installed cost w/ engineering and CM of \$2.1M**

OPERATION FACTORS

- Tie into existing heat loop
- Waste heat using new heat exchangers and plant process water
- New waste gas heat exchangers to capture heat for digesters
- Engine output tied to available methane gas production
- 2nd unit in standby mode

JENBACHER ENGINE UNITS



GAS COMPRESSORS & FILTERS



DIGESTERS



COST BENEFIT ASSUMPTIONS - 1996

- Reduce electrical bills from PSCO
- Energy Charges decreasing from 2.9¢ to 1.9¢ per KWH
- Demand Charges increasing from 1.7¢ to 2.1¢ per KW
- Simple payback possible in 7 years with a 30 year design life

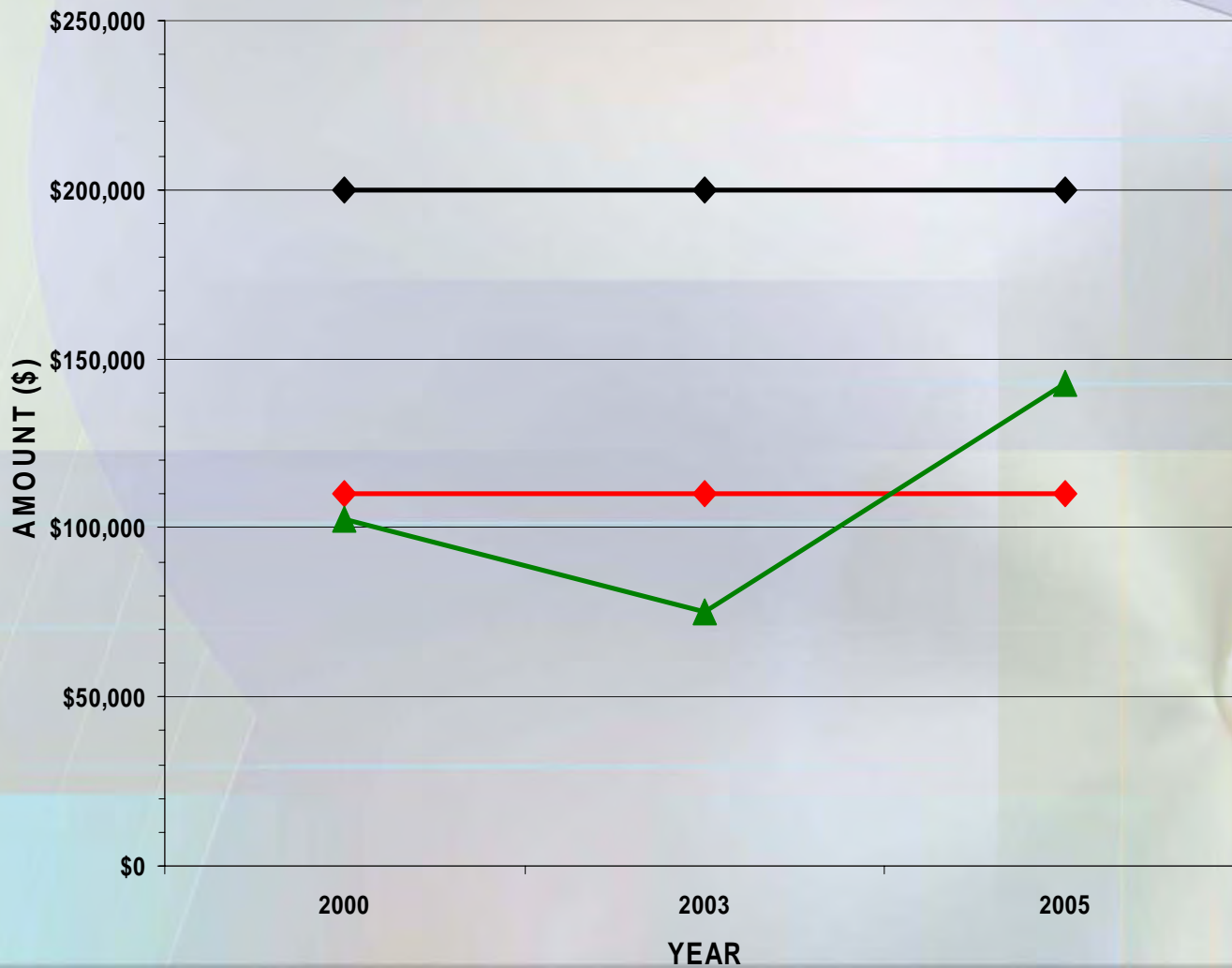
ADDITIONAL COSTS INCURRED

- **Operations**
- **Maintenance contracted out**
- **Ferric addition to reduce H₂S**
- **Maintenance due to siloxane deposits**
- **Reduced performance due to moisture and siloxane**
- **PSCO (Xcel) base rate structure**
- **Xcel Standby Rate and Safety**

PERFORMANCE INDICATORS

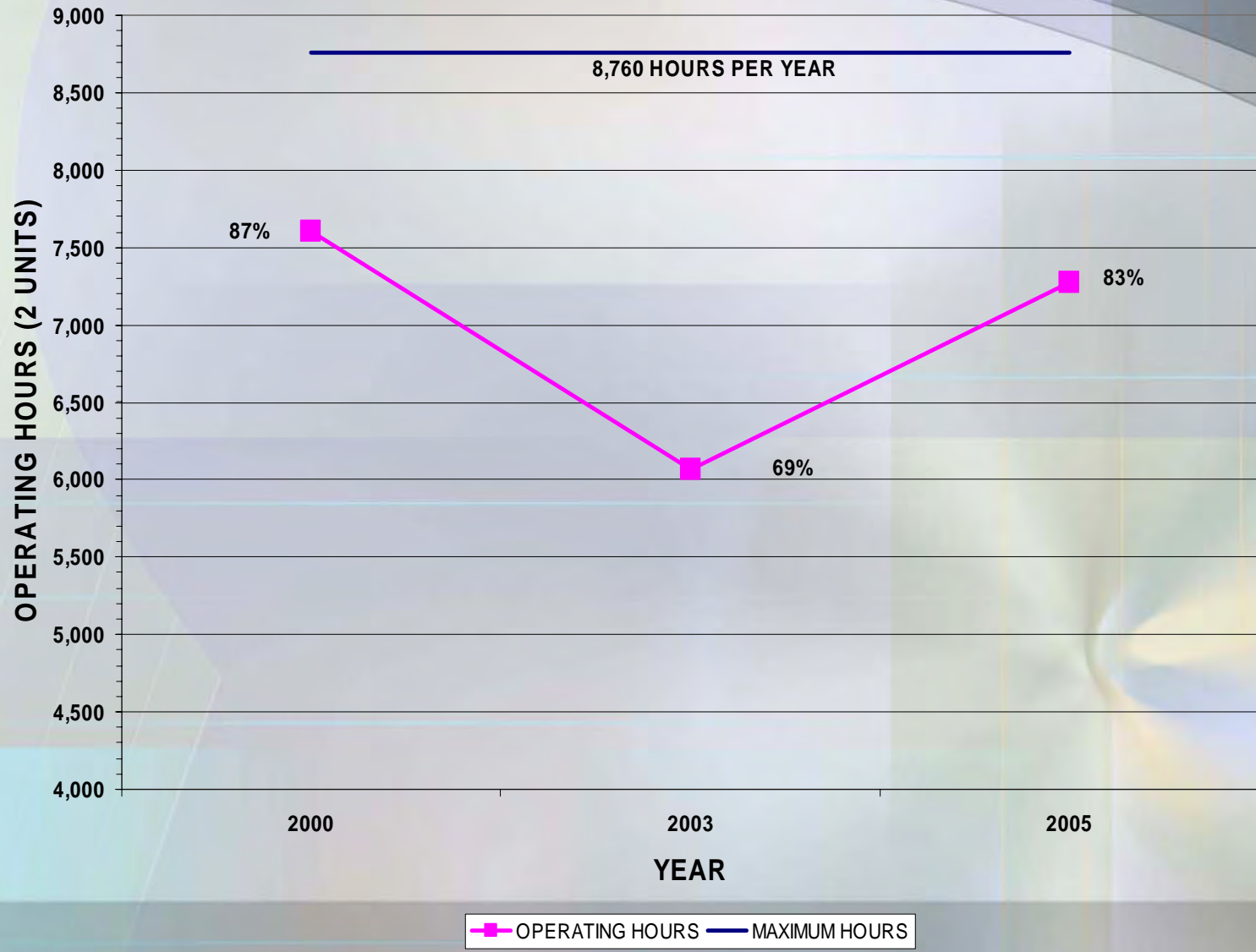
- **Less than maximum KWH**
- **Less than maximum run hours**
- **No reduction in Demand Charges**
- **Engine downtime is significant and requires heat source backup**

COGEN DEPRECIATION & OPERATING COSTS

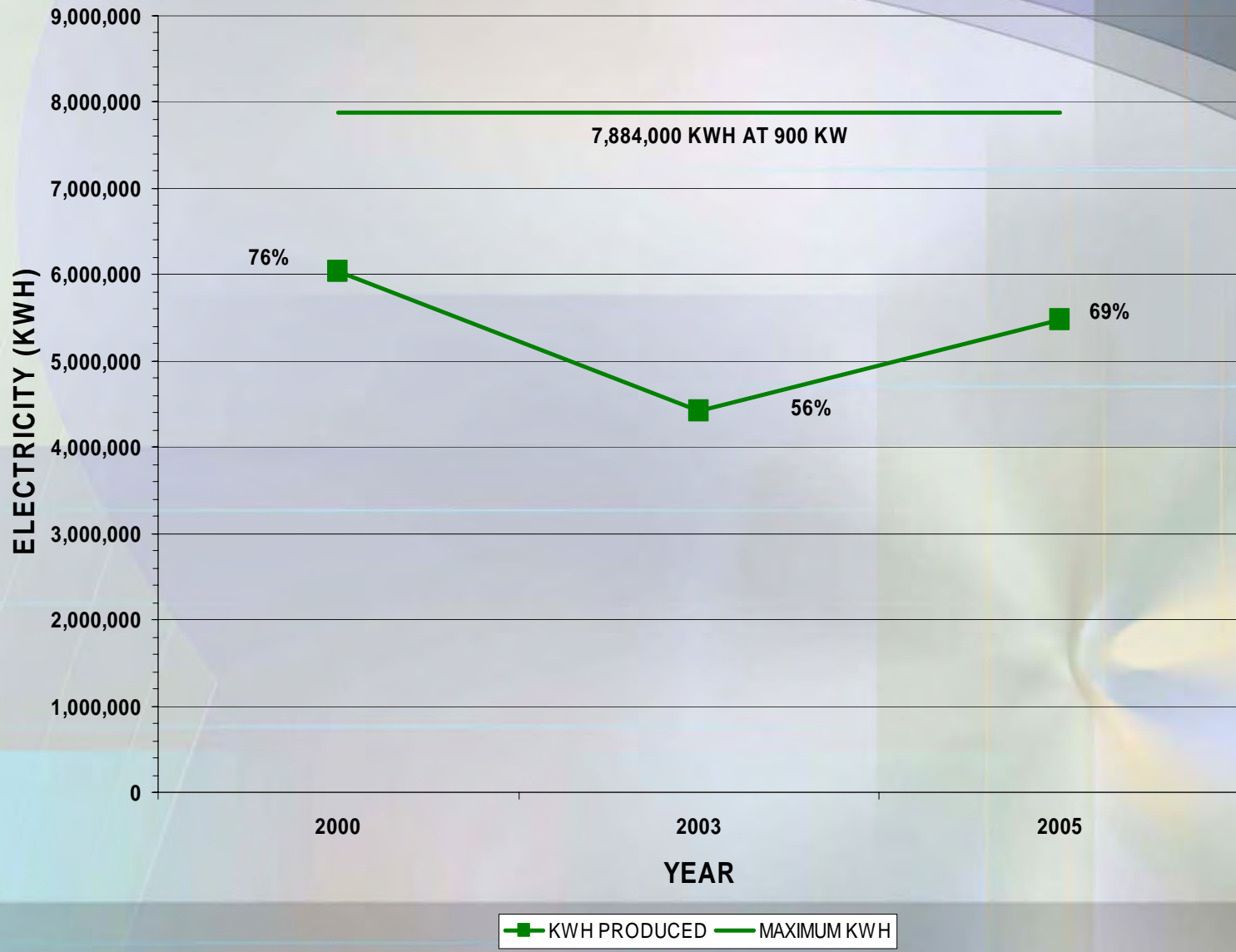


◆ ANNUAL DEPRECIATION ◆ OPERATING COST ▲ ELECTRICAL OFFSET COST

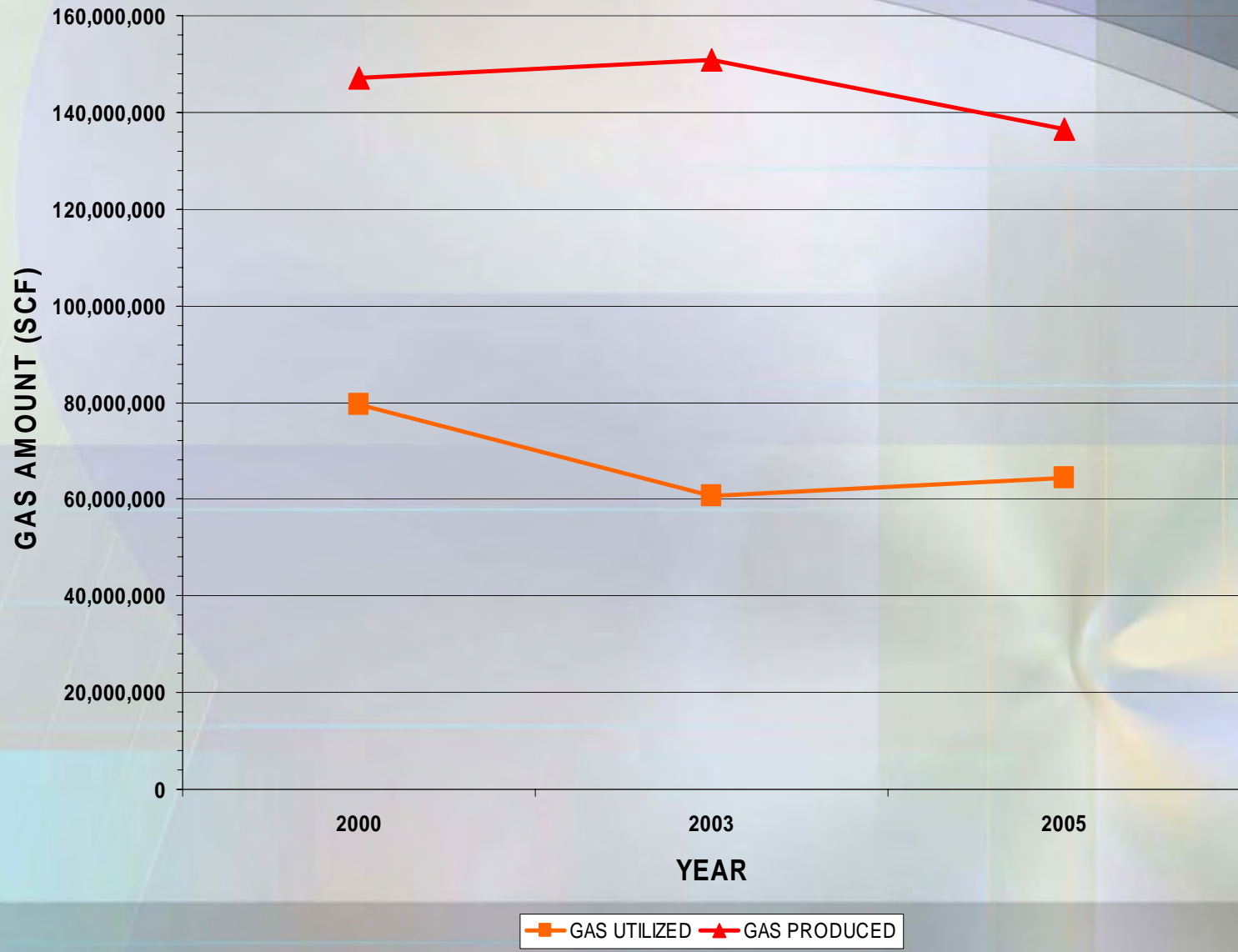
COGEN OPERATING HOURS



ELECTRICAL PRODUCTION



METHANE GAS UTILIZATION



COGENERATION PROJECT

- **Questions?**