Energy Cost Comparisons of Center Pivot Systems in the Northern Texas High Plains

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Introduction

- Northern Texas High Plains - one of the intensively cropped areas in the United States
- Water for irrigation comes mainly from the Ogallala aquifer
- Irrigated crop production-major component of the regional economy
- Major irrigated crops - corn, cotton, sorghum and wheat

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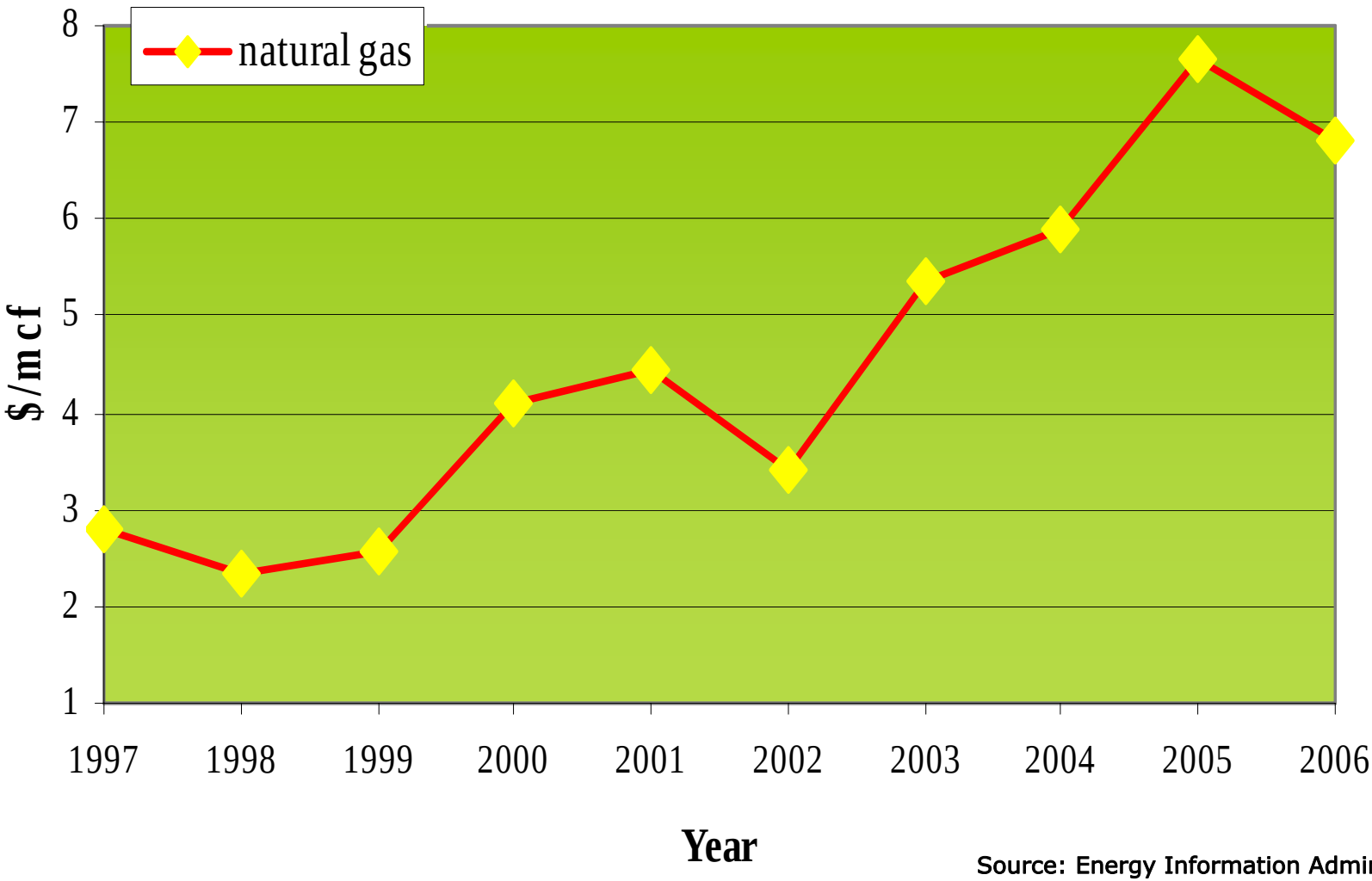
- Northern Texas High Plains has 0.8 m acres under sprinkler systems (TWDB 2000)
- About 75 percent of irrigated acres in Texas High Plains utilize center pivot systems
  - 45% low pressure,
  - 45% medium pressure,
  - 10% high pressure (USDA 2002)
- Natural gas is the main source of energy to pump groundwater

Problems in Texas High Plains

- Of 14 million irrigated acres in the US where ground water resources are declining, 4.8 million acres are in Texas (National Research Council 1996)
- High irrigation water demands
- Withdrawals increased approximately five fold in fifty years
- Decreased well yields, increased pump lifts are a result of steadily declining available water volume
- Escalating energy prices - increased costs for withdrawals

Average Natural Gas Prices in Texas, 1997-2006



Source: Energy Information Administration

Available Alternatives

- Adoption of more efficient systems
- Conversion from medium and high pressure to low pressure systems

  -reducing the pressure requirements cuts down the energy costs

  -reduce use of scarce inputs

  -maintain production levels

Objective of the Study

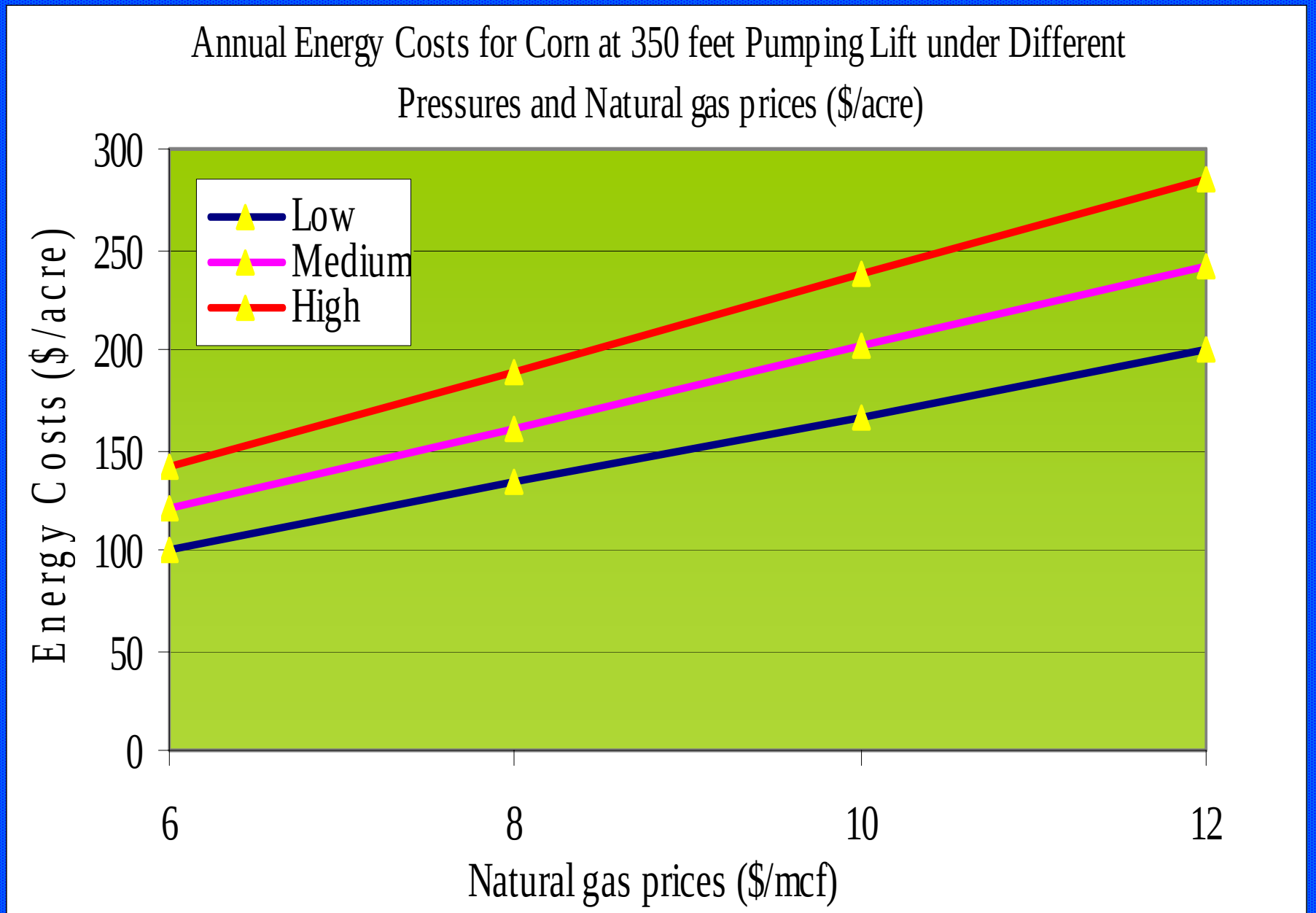
- Estimate the annual energy costs of center-pivot systems considering natural gas as the source of energy under high, medium, and low- pressure heads.
- Determine the savings in annual energy costs associated with the change from medium and high pressure systems to low pressure systems

Methodology

- Center-pivot systems - high pressure (80 psi), medium pressure (45 psi), low pressure (25 psi)
- Five pump lifts - 250, 300, 350, 400, and 450 feet
- Corn crop with an yield level of 120 bu/acre and water requirement of 22 in/acre is selected
- Energy costs are calculated at natural gas prices of $6, $8, $10, and $12 per mcf
- Savings in energy costs are determined

Annual Energy Costs for Corn at 350 feet Pumping Lift under Different Pressures and Natural gas prices ($/acre)

Gas price ($/mcf)	High	Medium	Low
6	142	121	100
8	189	161	133
10	237	202	167
12	284	242	200


Annual Energy Costs for Corn at 350 feet Pumping Lift under Different Pressures and Natural gas prices ($/acre)
Energy Costs ($/acre)
300
250
200
150
100
50
0
Low
Medium
High
6
8
10
12
Natural gas prices ($/mcf)

Savings in Annual Energy Costs for Corn by Converting to Low Pressure at 350 feet Pumping Lift under Different Natural gas Prices ($/acre)

Gas price ($/mcf)	Med - Low	High - Low
6	21	42
8	27	56
10	35	70
12	42	84

Conclusion

- Energy costs range from $75 per acre for low pressure systems at $6/mcf natural gas price at 250 feet lift to $337 per acre for high pressure systems at $12 /mcf at 450 feet lift.

- Savings in energy costs by converting from medium to low pressure systems range from $19 per acre at $6/mcf natural gas price at 250 feet lift to $45 per acre at $12/mcf at 450 feet lift.

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- Savings in energy costs by converting from high to low pressure systems range from $40 per acre at $6/mcf natural gas price at 250 feet lift to $88 per acre at $12/mcf at 450 feet lift.
- Low pressure systems are more efficient than medium and high pressure systems
- Every gallon of water pumped consumes energy and as energy prices continue to increase, more efficient systems mean more money in your pocket

Comments/Questions