COST-OPTIMIZED PUMPING IN THE PHOSPHATE INDUSTRY

by Eric Coffin

Thank You

- **Bob Andrews**
- **Francine Neuman**

Thank You

Florida Institute of Phosphate Research

- Gary Albarelli
- Karen Stewart
- Malysavanh Birdy

Thank You

- George Mcquien
- Mark Thompson
- Terry Tarte

Thank You

Cris Coffin

Wife for 32 years

COST-OPTIMIZED PUMPING IN THE PHOSPHATE INDUSTRY

COST- **OPTIMIZED**

PUMPING IN THE PHOSPHATE INDUSTRY

COST-OPTIMIZED
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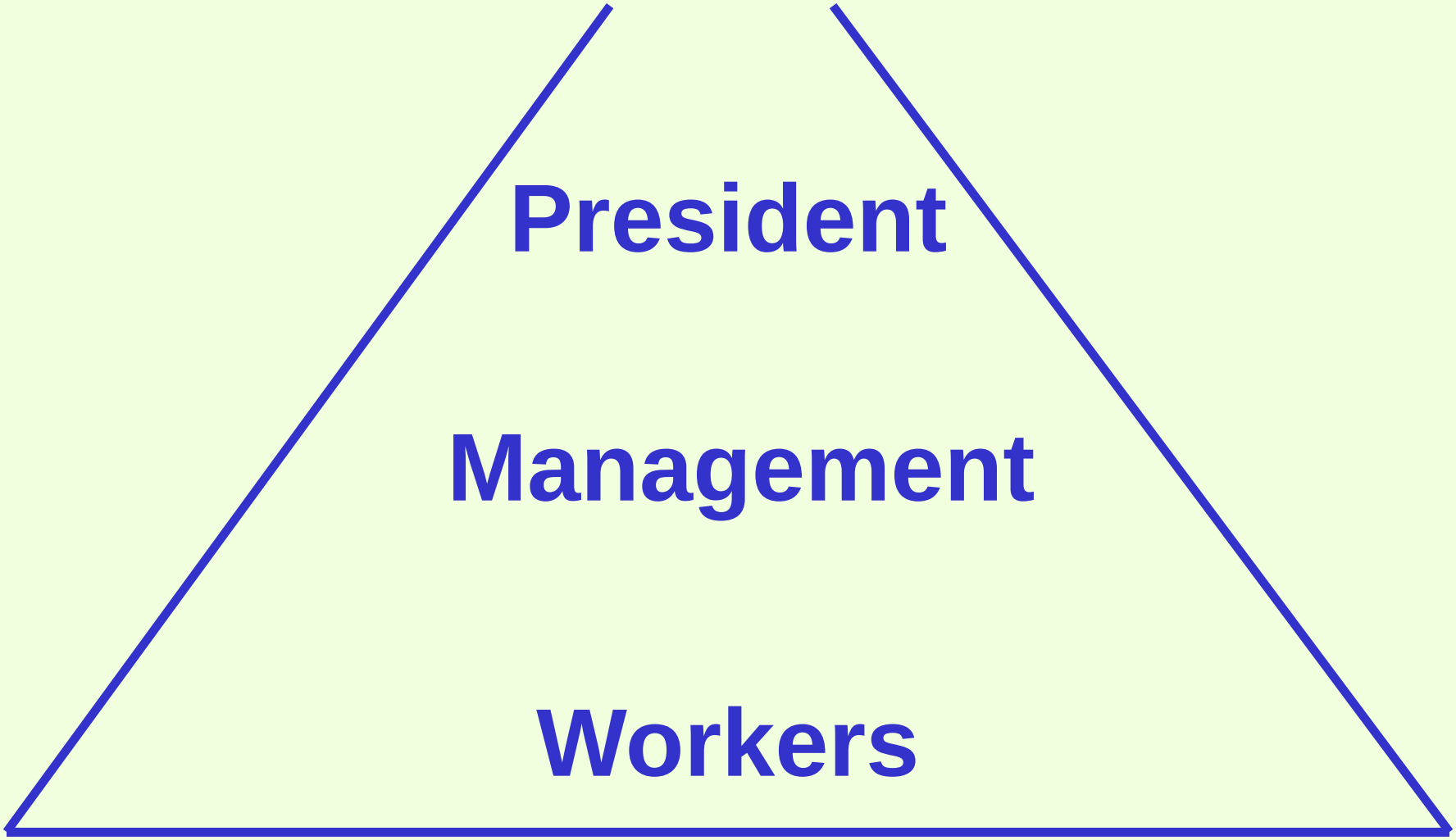
PHOSPHATE INDUSTRY

Corporate Profits



Stockholders

Board of Directors

President

Eng Const Oper Main

Engineering

Engineering Material Specification Drawings Pumps

Construction

Construction
Bids
Right of Way
Permits
Trencher
Cranes
Welders
Weather

Operations

Operations
Workers
Inspection
Safety
Schedules
Training

Maintenance

Maintenance
Staff
Accidents
Inspection
Equipment
Access
Spare Parts

Stockholders

Stockholders
WSJ
Investment
Profit

Stockholders

Board of Directors

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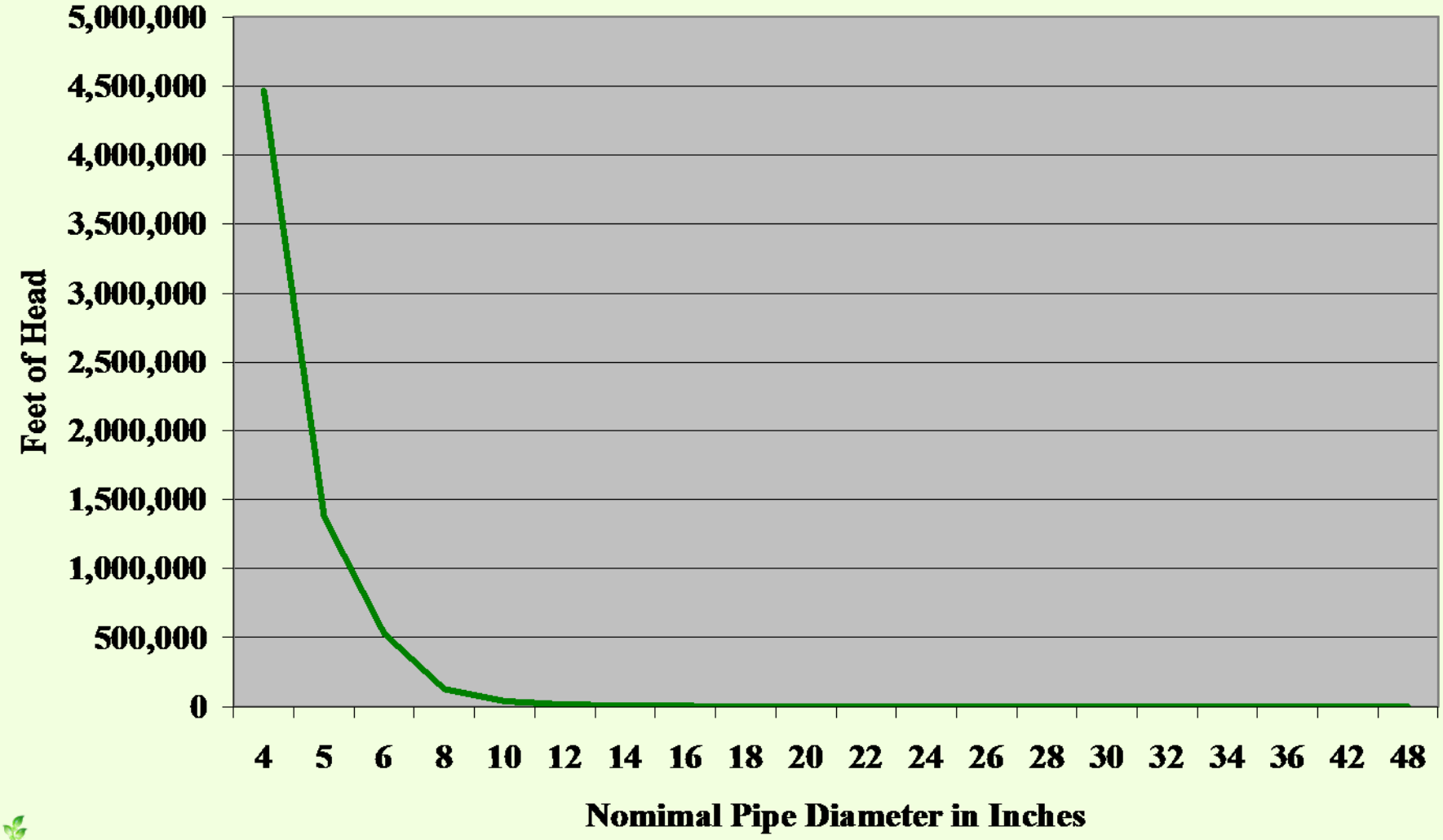
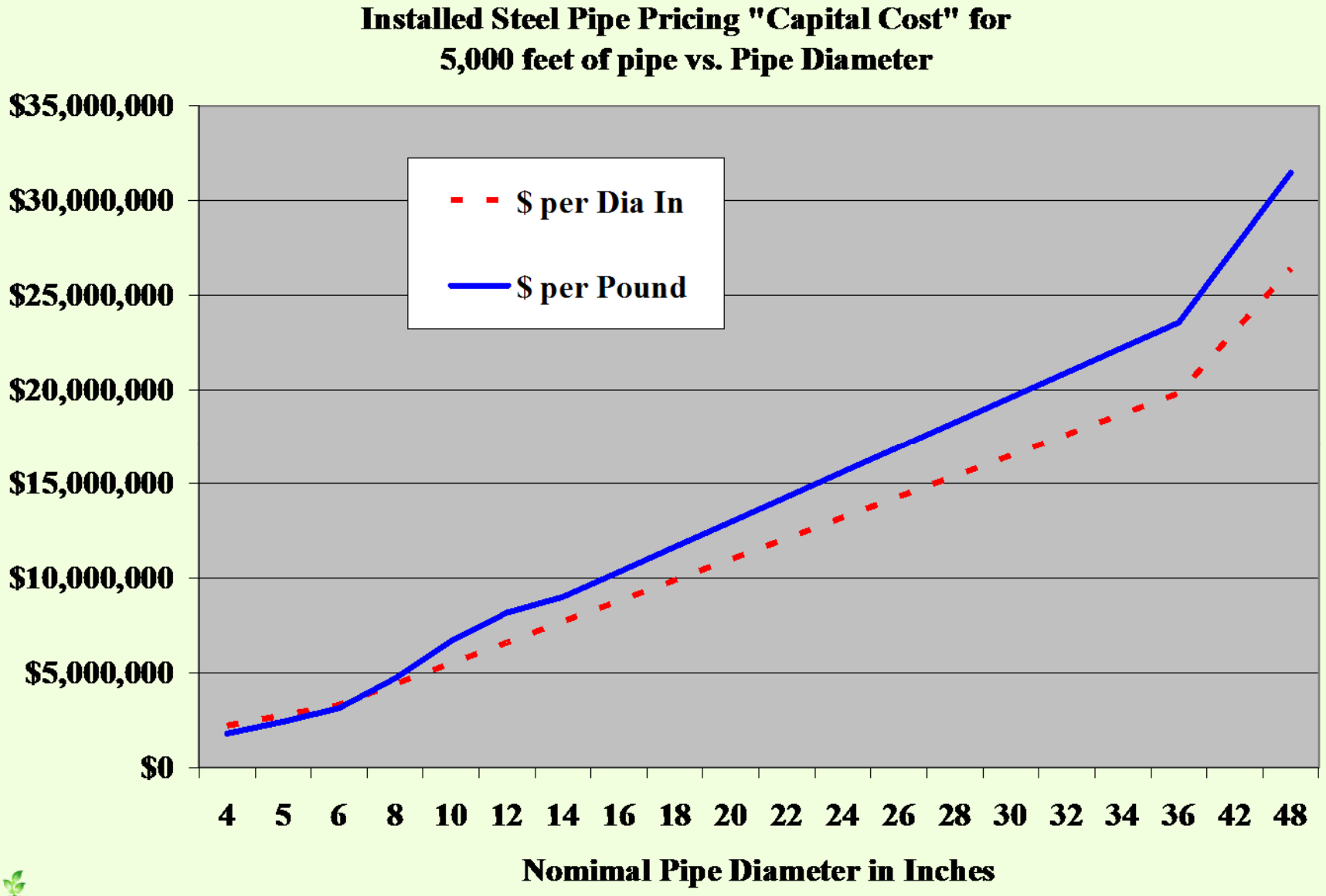
Head Loss in Pipes

$$h = f * \frac{L}{D} * \frac{V^2}{2g}$$

Head Loss in Feet of Water for 1,000 GPM of clean water flowing in a 5,000 foot long Steel Pipe





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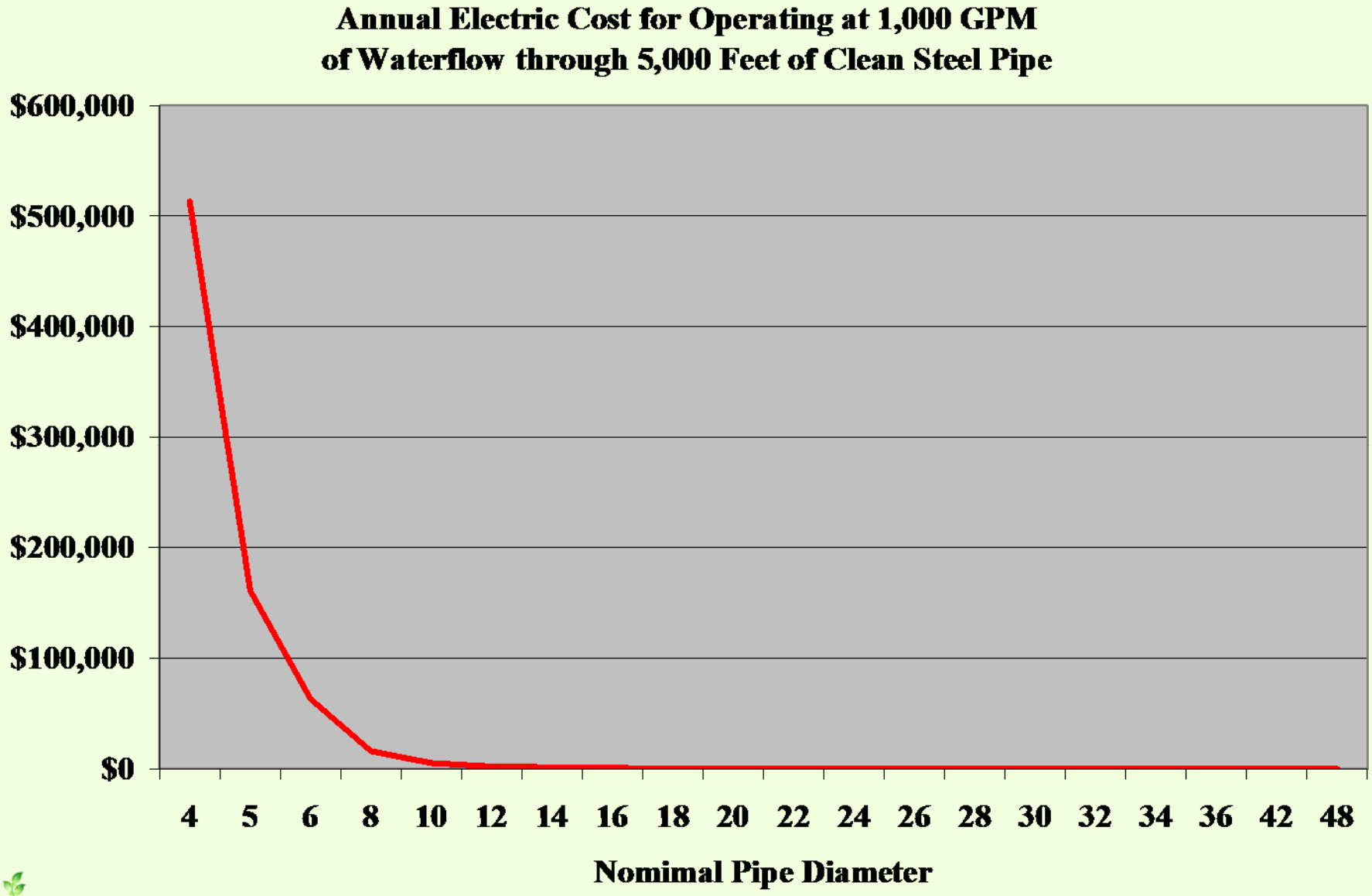
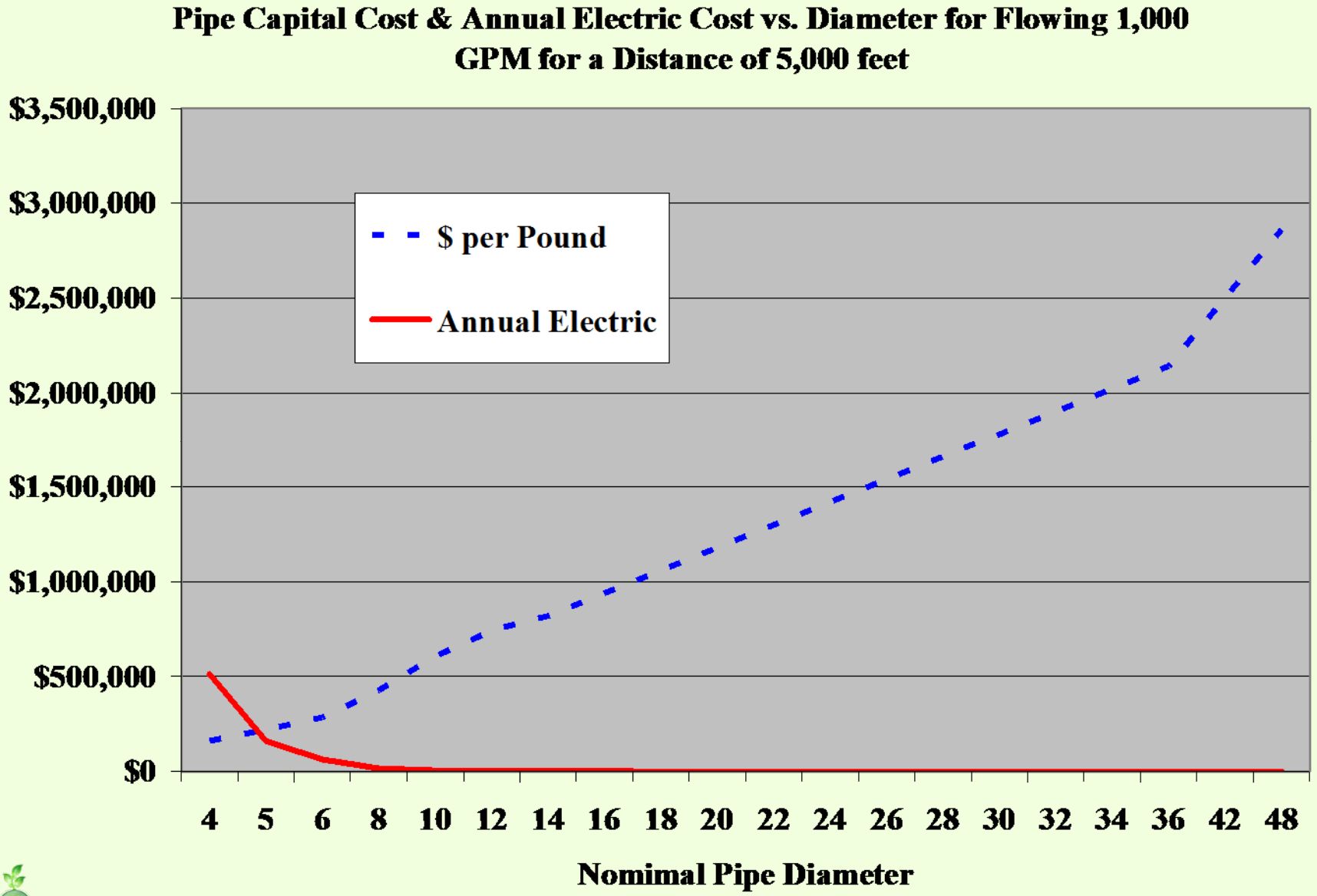




Incremental Investment and Incremental Return (IIIR)

$$y = ax + \frac{b}{x} + c$$

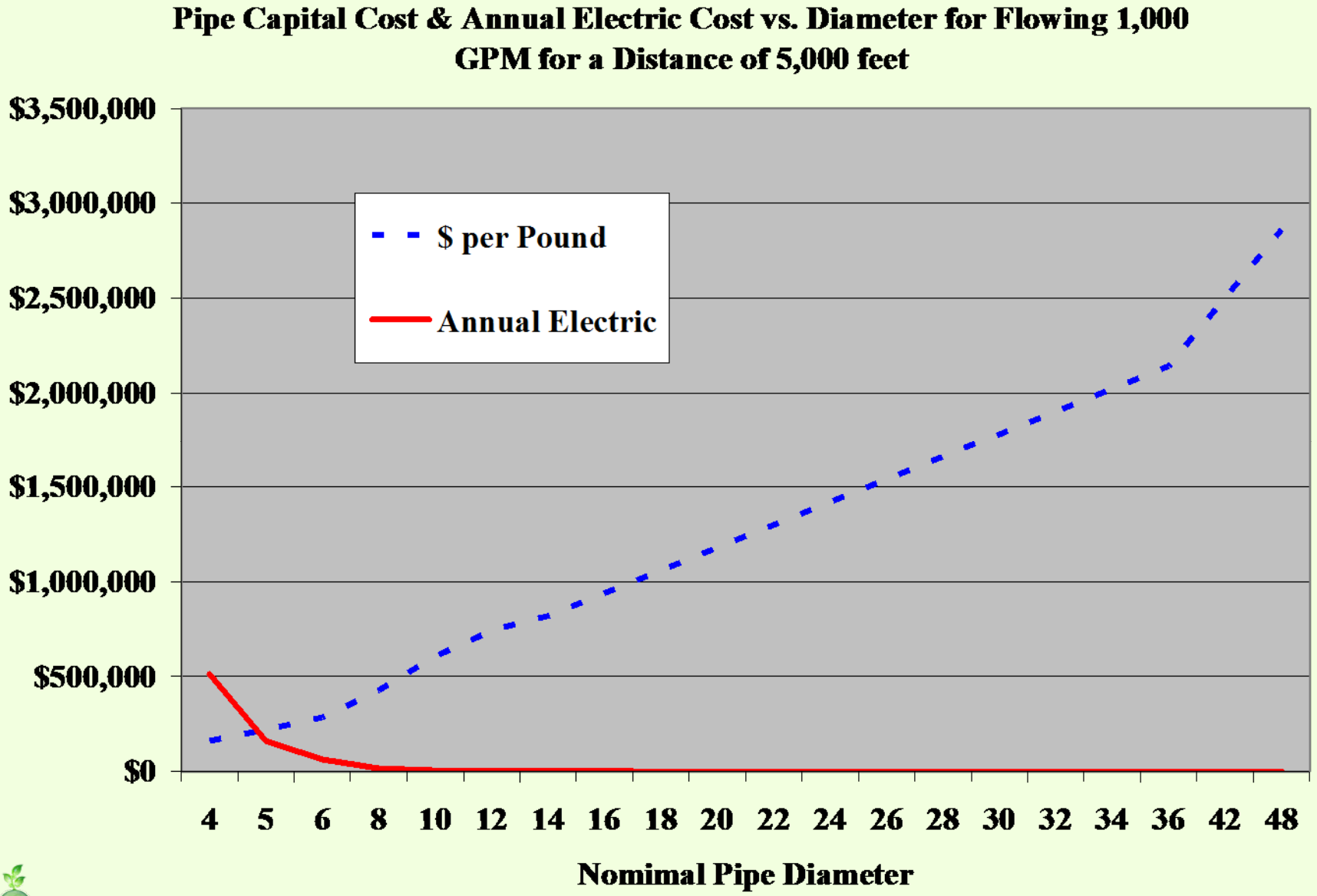
y = the total cost
x = the variable of design
a, b, c are coefficients

$$x = \sqrt{\frac{b}{a}}$$

X = Minimum cost point

The ***a*** and ***b*** of optimized **pipes** & **pumping**

- ***a***
  - Annual Cost
  - Energy
  - Maintenance
- ***b***
  - First Cost
  - Capital
  - (A/P, i, n)



The *a* and *b* of optimized pipes & pumping

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- ***b***
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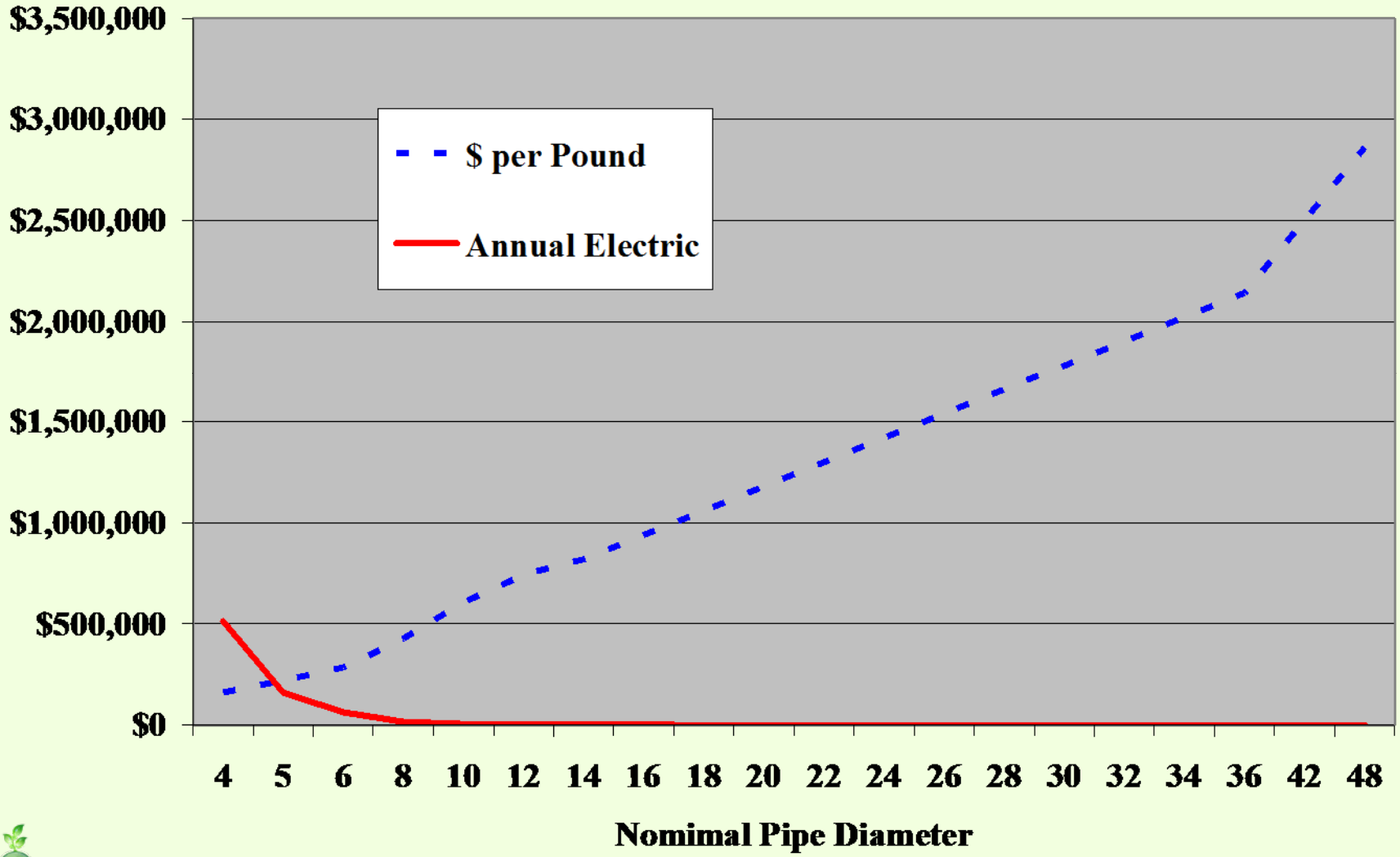
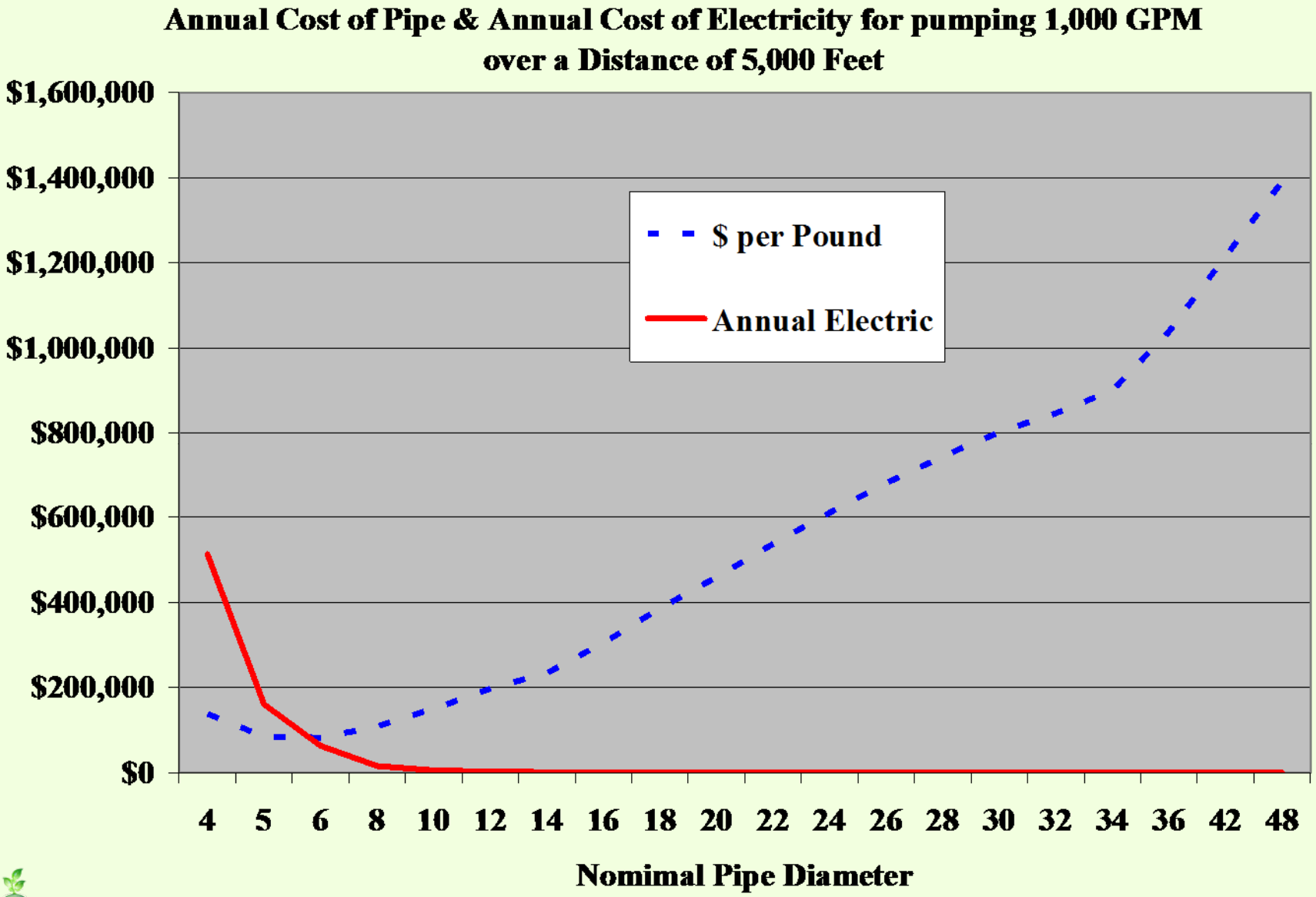
  - **(A/P, i, n)**

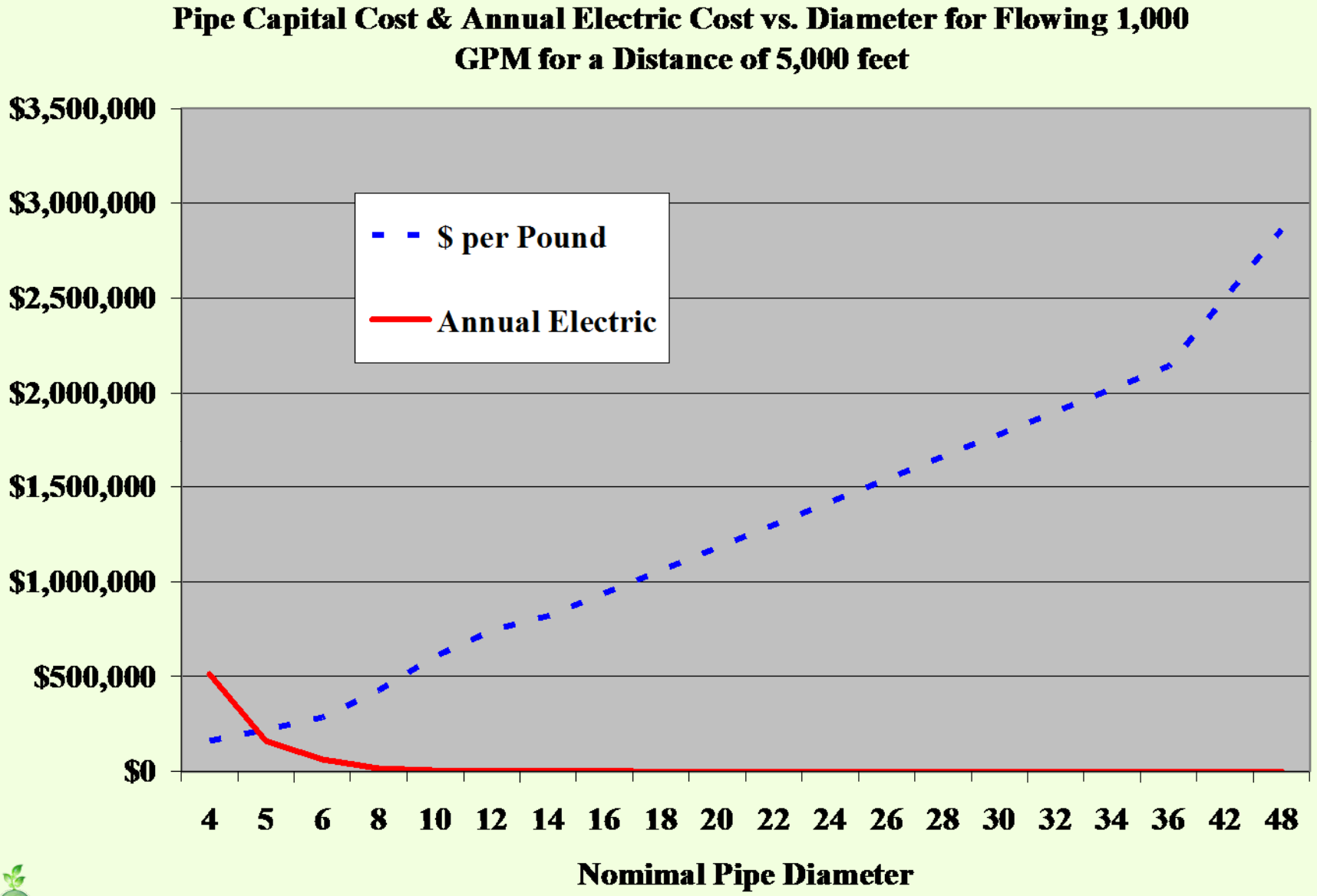
The *a* and *b* of optimized pipes & pumping

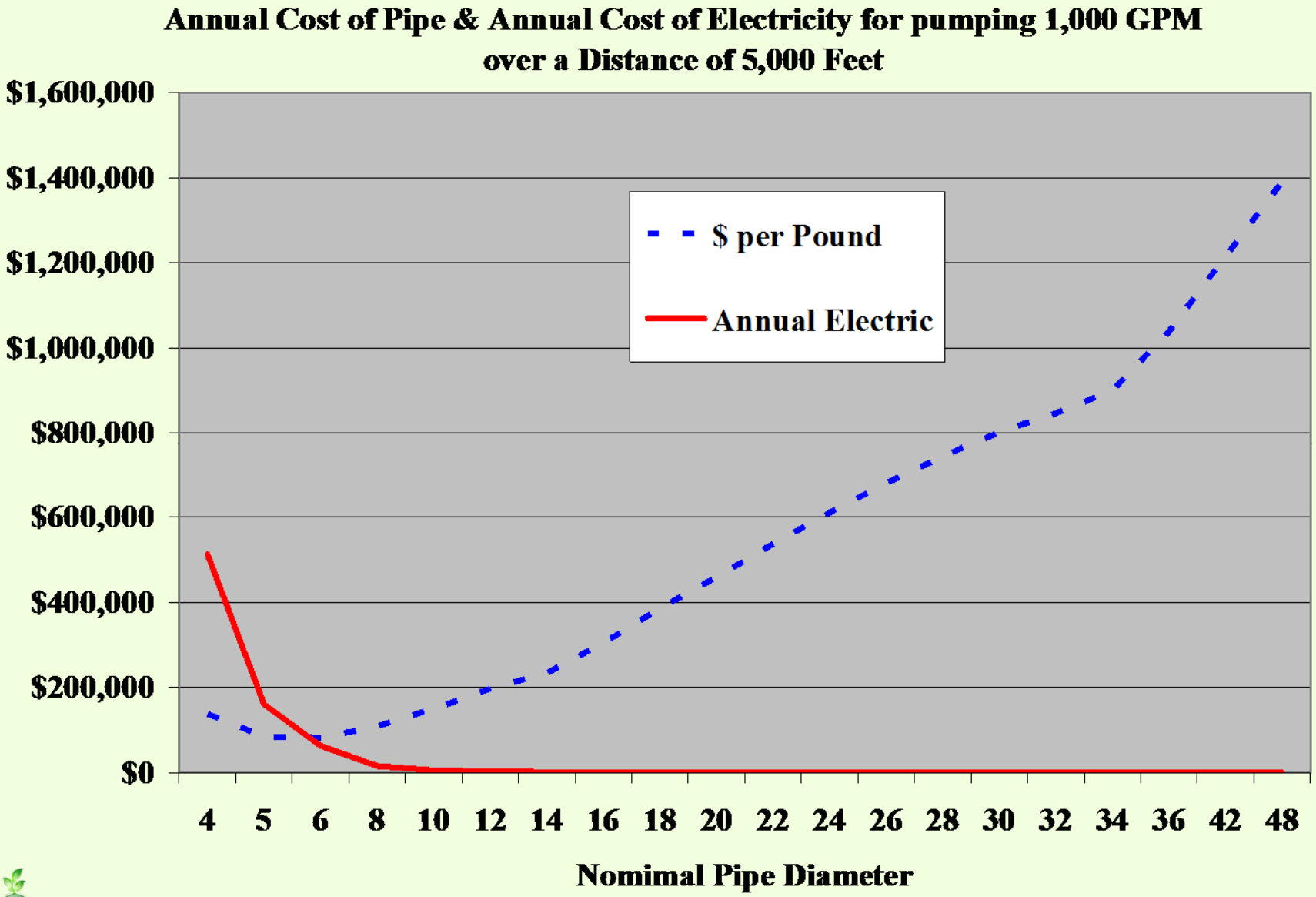
- *a*
  - **Annual Cost**
  - Energy
  - Maintenance
- *b*
  - First Cost
  - Capital
  - **(A/P, i, n)**

Pipe Capital Cost & Annual Electric Cost vs. Diameter for Flowing 1,000 GPM for a Distance of 5,000 feet









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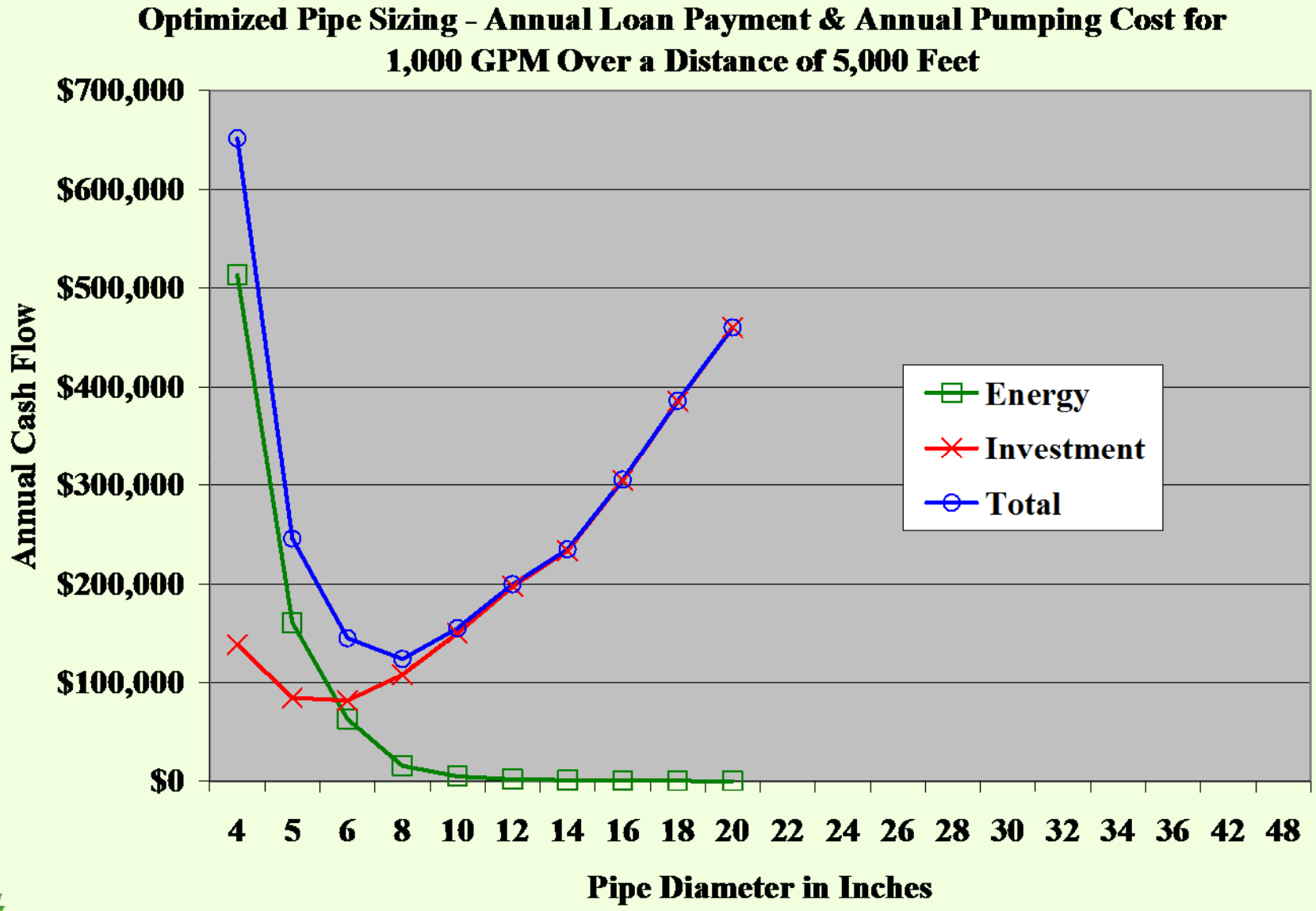
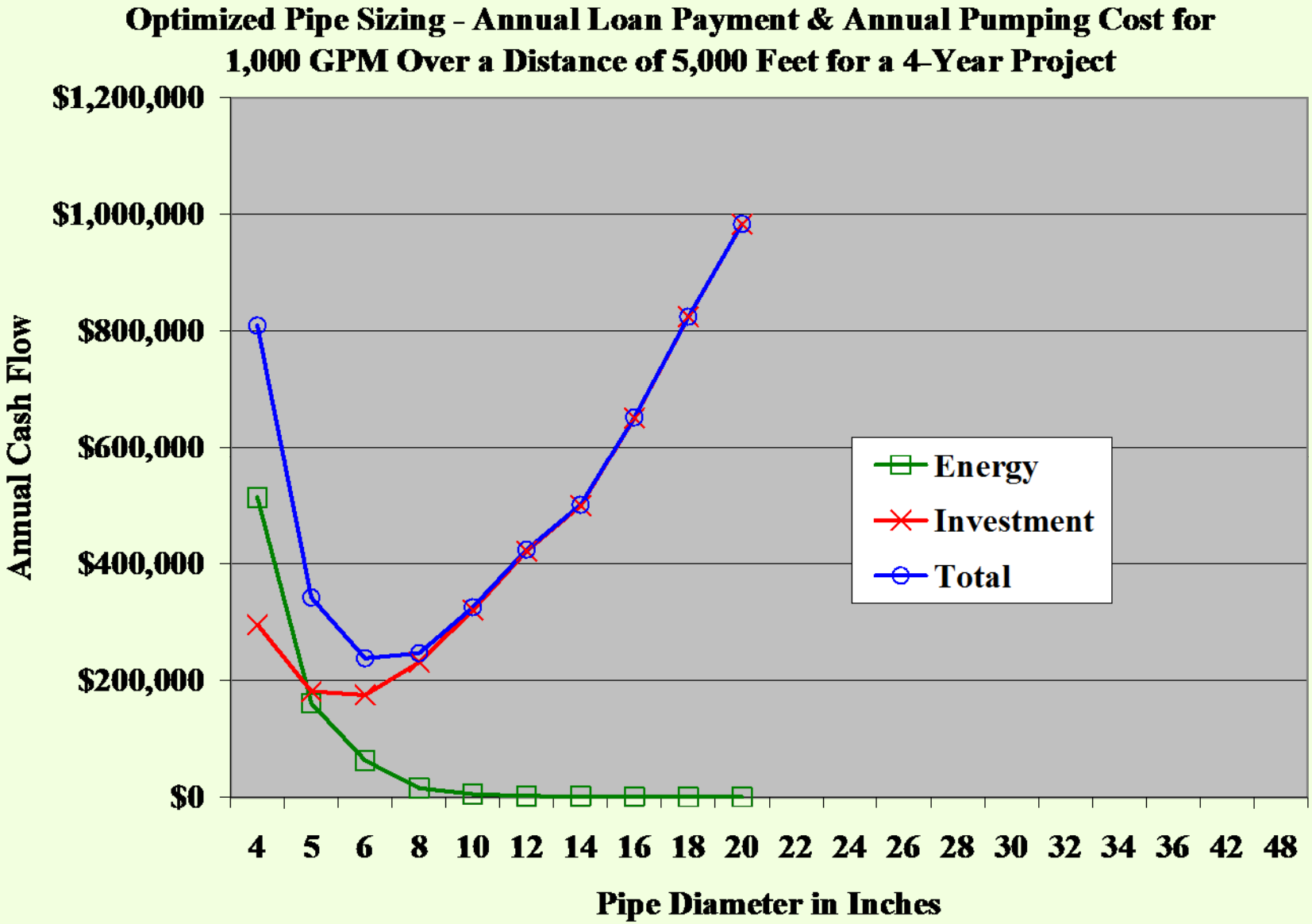
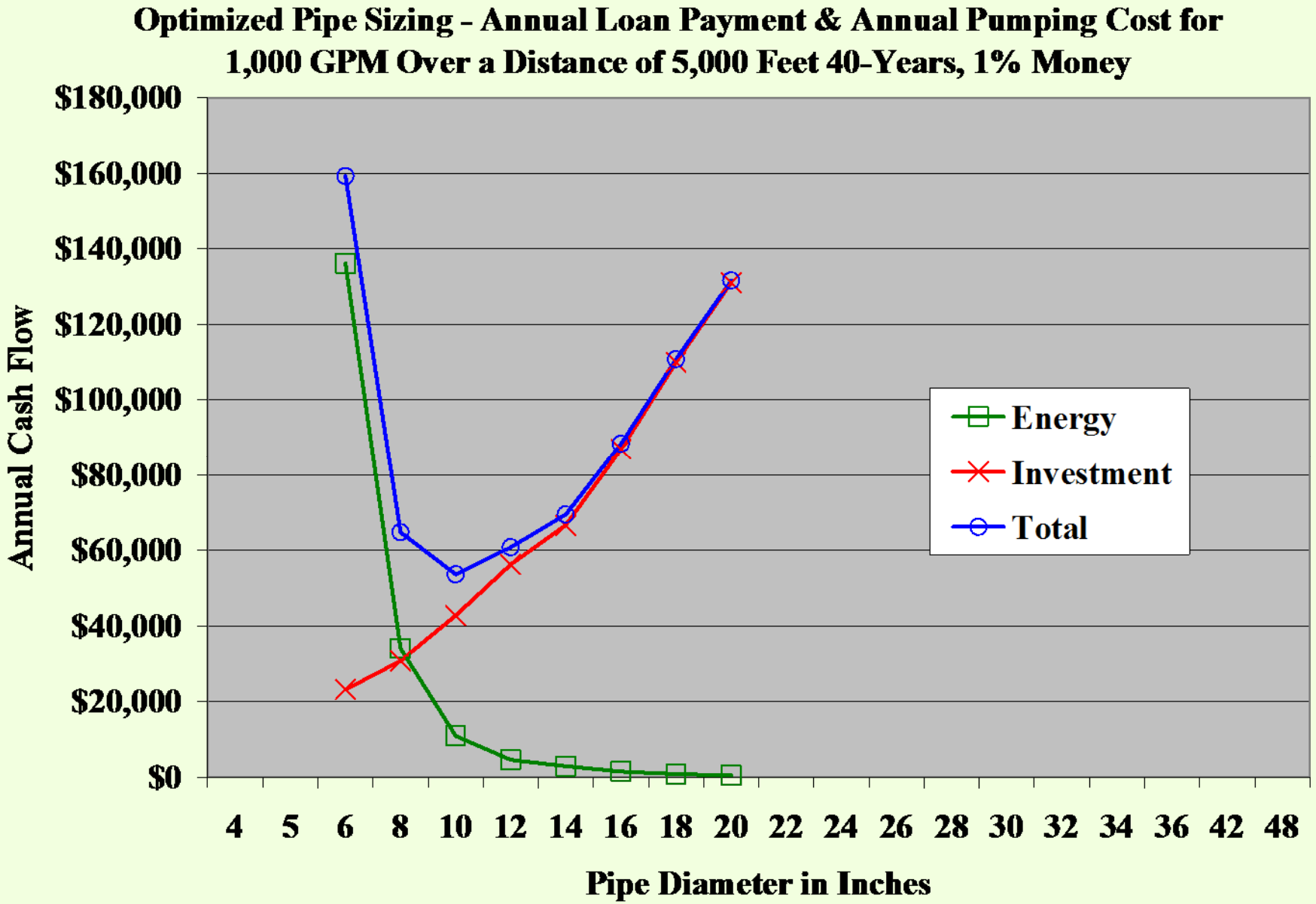
$$x = \sqrt{\frac{b}{a}}$$



- **Short Life**
- **Cheap Energy**
- **Few Hours of Operation**



- **40-Year Life**
- **8,760 Hours of Operation**
- **Expensive Energy**
- **Low Finance Cost**



- **Optimization**
- **Capital**
- **Operation and Maintenance**

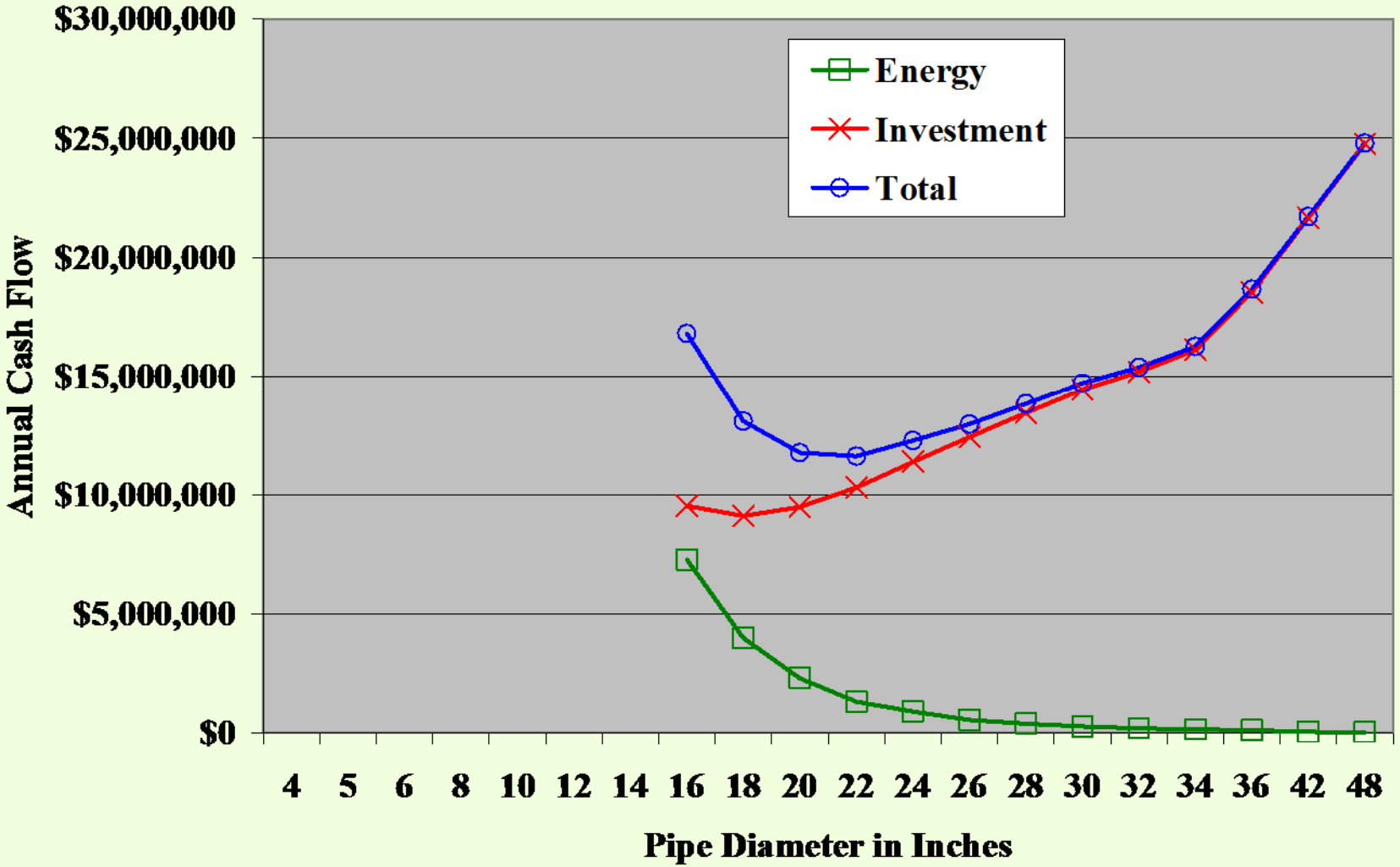
- **Project Life**
- **Interest Rate**
- **Hours of Operation**
- **Pump Efficiency**
- **Motor Efficiency**

- **Water**
- **50,000 Feet**
- **13,000 GPM**
- **80% Pump Efficiency**
- **96% Motor Efficiency**

- 7,280 Hours
- $0.07 per kWh
- 5-Year Project Life

- **12% Loan Interest Rate**
- **Maintenance is 4% of Capital**

Optimized Pipe Sizing - Annual Loan Payment & Annual Pumping Cost for 13,000 GPM Over a Distance of 50,000 Feet



- **Engineering Optimization**
- **Test for Corporate Profits**

- XYZ Pipe Company
- $21,000,000 sales
- 28% tax bracket

- **Sales to Increase 2% per year**
- **Operating Expense $14,000,000**

Engineers present Management with

3 new pipeline proposals

Pipe Diameter	20	22	24
Energy	$2,521,000	$1,425,000	$967,000
Investment	$6,572,000	$7,135,000	$7,880,000
Total	$9,093,000	$8,560,000	$8,848,000

Sales	$21,000,000

Sales	**$21,000,000**
Operating Expense	**$14,000,000**

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Operating Expense	**$14,000,000**
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Adjusted Gross Profit	$7,000,000
Taxes at 28%	$1,960,000

Sales	$21,000,000
Operating Expense	$14,000,000
Gross Profit	$7,000,000
Less Depreciation	$0
Adjusted Gross Profit	$7,000,000
Taxes at 28%	$1,960,000
Net Profit	$5,040,000

Sales	$21,000,000
Operating Expense	$14,000,000
Gross Profit	$7,000,000
Less Depreciation	$0
Adjusted Gross Profit	$7,000,000
Taxes at 28%	$1,960,000
Net Profit	$5,040,000
Cash on the books	$5,040,000

XYZ Pipe Company

Sales	$21,000,000	$21,420,000	$21,848,400	$22,285,368	$22,731,075
Operating Expense	$14,000,000	$14,000,000	$14,000,000	$14,000,000	$14,000,000
Gross Profit	$7,000,000	$7,420,000	$7,848,400	$8,285,368	$8,731,075
Less Depreciation	$0	$0	$0	$0	$0
Adjusted Gross Profit	$7,000,000	$7,420,000	$7,848,400	$8,285,368	$8,731,075
Taxes at 28%	$1,960,000	$2,077,600	$2,197,552	$2,319,903	$2,444,701
Net Profit	$5,040,000	$5,342,400	$5,650,848	$5,965,465	$6,286,374
Cash on the books	$5,040,000	$5,342,400	$5,650,848	$5,965,465	$6,286,374

20-Inch Pipe Company

Sales	$21,000,000	$21,420,000	$21,848,400	$22,285,368	$22,731,075
Operating Expense	$16,521,057	$16,521,057	$16,521,057	$16,521,057	$16,521,057
Gross Profit	$4,478,943	$4,898,943	$5,327,343	$5,764,311	$6,210,018
Less Depreciation	$1,314,402	$1,314,402	$1,314,402	$1,314,402	$1,314,402
Adjusted Gross Profit	$3,164,541	$3,584,541	$4,012,941	$4,449,909	$4,895,617
Taxes at 28%	$886,072	$1,003,672	$1,123,624	$1,245,975	$1,370,773
Net Profit	$2,278,470	$2,580,870	$2,889,318	$3,203,935	$3,524,844
Net Profit + Depreciation	$3,592,871	$3,895,271	$4,203,719	$4,518,336	$4,839,246

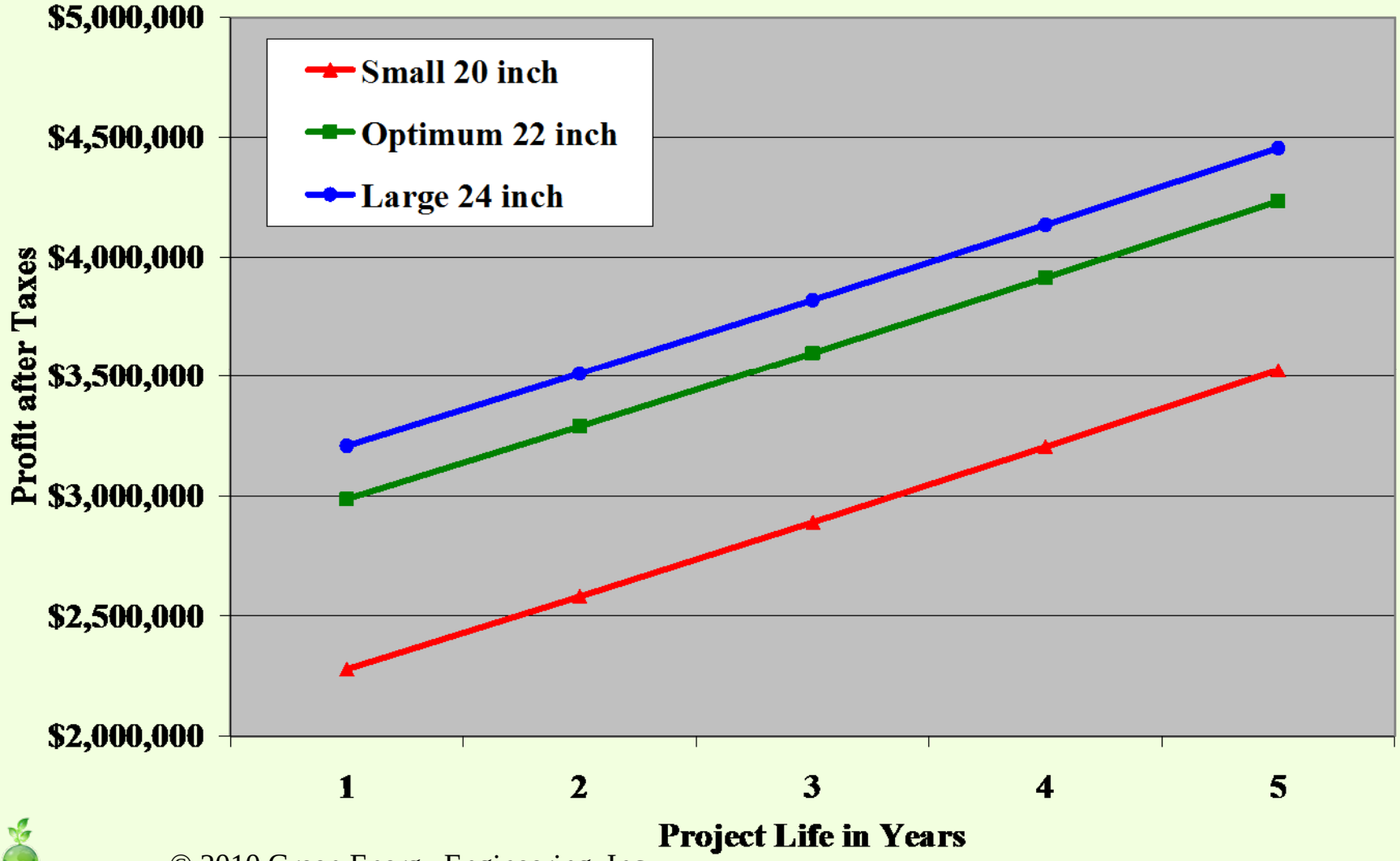
22-Inch Pipe Company

Sales	$21,000,000	$21,420,000	$21,848,400	$22,285,368	$22,731,075
Operating Expense	$15,424,923	$15,424,923	$15,424,923	$15,424,923	$15,424,923
Gross Profit	$5,575,077	$5,995,077	$6,423,477	$6,860,445	$7,306,152
Less Depreciation	$1,427,032	$1,427,032	$1,427,032	$1,427,032	$1,427,032
Adjusted Gross Profit	$4,148,045	$4,568,045	$4,996,445	$5,433,413	$5,879,121
Taxes at 28%	$1,161,453	$1,279,053	$1,399,005	$1,521,356	$1,646,154
Net Profit	$2,986,593	$3,288,993	$3,597,441	$3,912,058	$4,232,967
Net Profit + Depreciation	$4,413,624	$4,716,024	$5,024,472	$5,339,089	$5,659,998

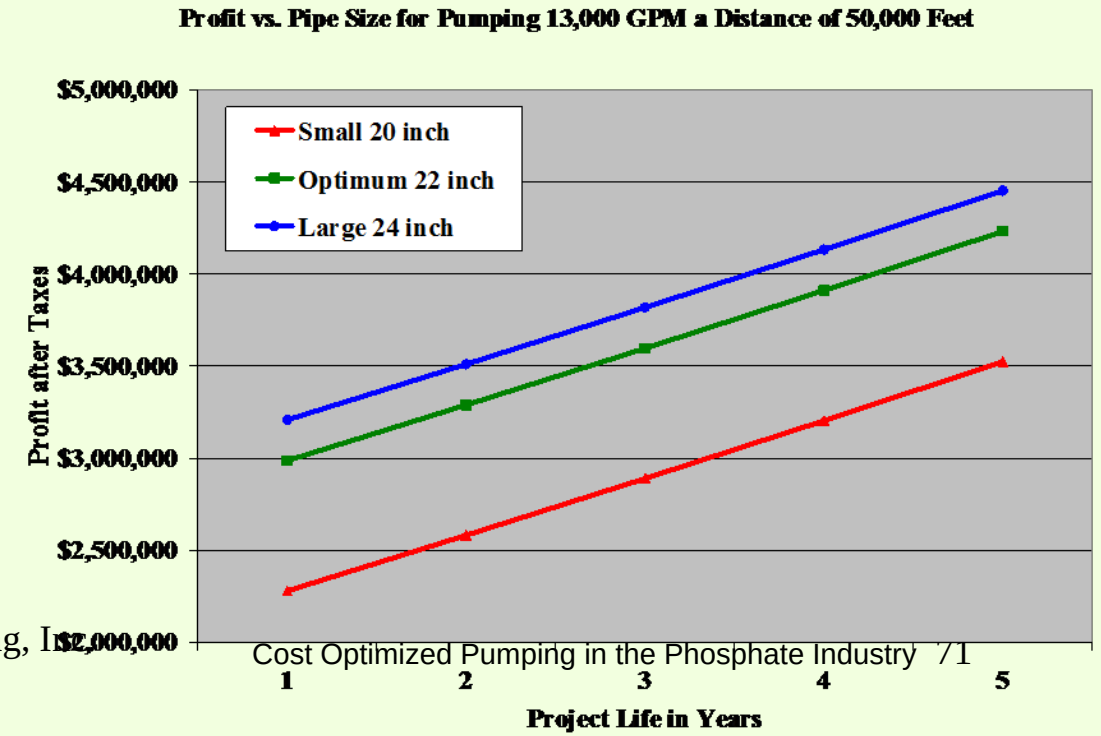
24-Inch Pipe Company

Sales	$21,000,000	$21,420,000	$21,848,400	$22,285,368	$22,731,075
Operating Expense	$14,967,888	$14,967,888	$14,967,888	$14,967,888	$14,967,888
Gross Profit	$6,032,112	$6,452,112	$6,880,512	$7,317,480	$7,763,187
Less Depreciation	$1,576,081	$1,576,081	$1,576,081	$1,576,081	$1,576,081
Adjusted Gross Profit	$4,456,030	$4,876,030	$5,304,430	$5,741,398	$6,187,106
Taxes at 28%	$1,247,688	$1,365,288	$1,485,240	$1,607,592	$1,732,390
Net Profit	$3,208,342	$3,510,742	$3,819,190	$4,133,807	$4,454,716
Net Profit + Depreciation	$4,784,423	$5,086,823	$5,395,271	$5,709,888	$6,030,797

Profit vs. Pipe Size for Pumping 13,000 GPM a Distance of 50,000 Feet



- 20-inch Red 8% ROI
- 22-inch Green 38% ROI
- 24-inch Blue 45% ROI



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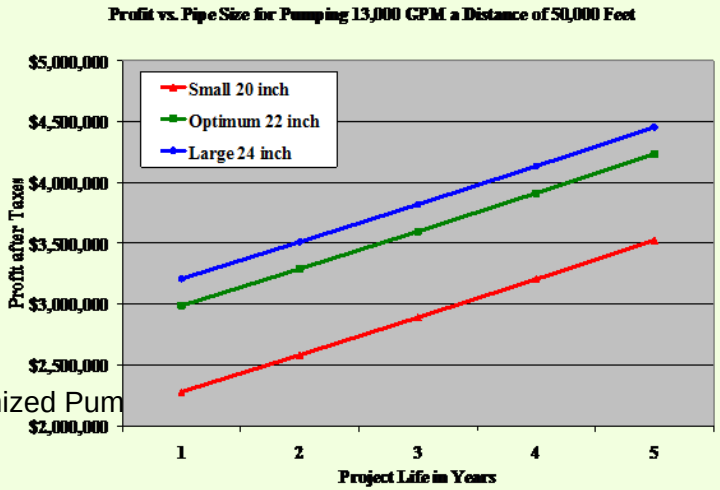
- 22-inch Green 38% ROI

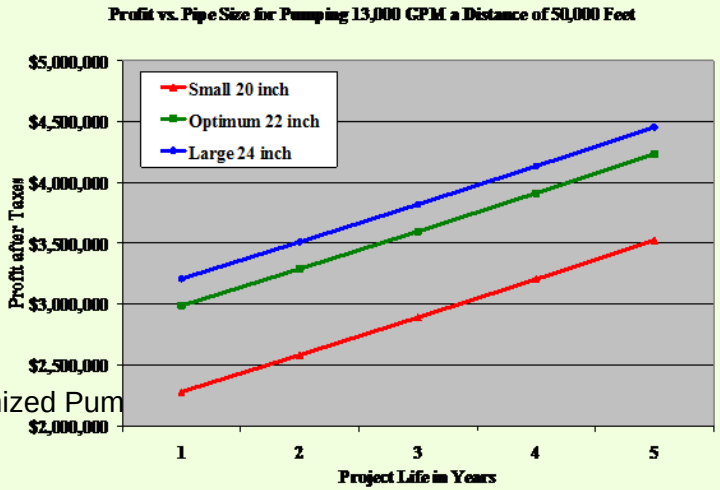
30% Increment



Cost Optimized Pum

- 22-inch Green 38% ROI
- 24-inch Blue 45% ROI

7%
Increment



Cost Optimized Pum

COST-OPTIMIZED PUMPING IN THE PHOSPHATE INDUSTRY

COST- **OPTIMIZED**

PUMPING IN THE PHOSPHATE INDUSTRY

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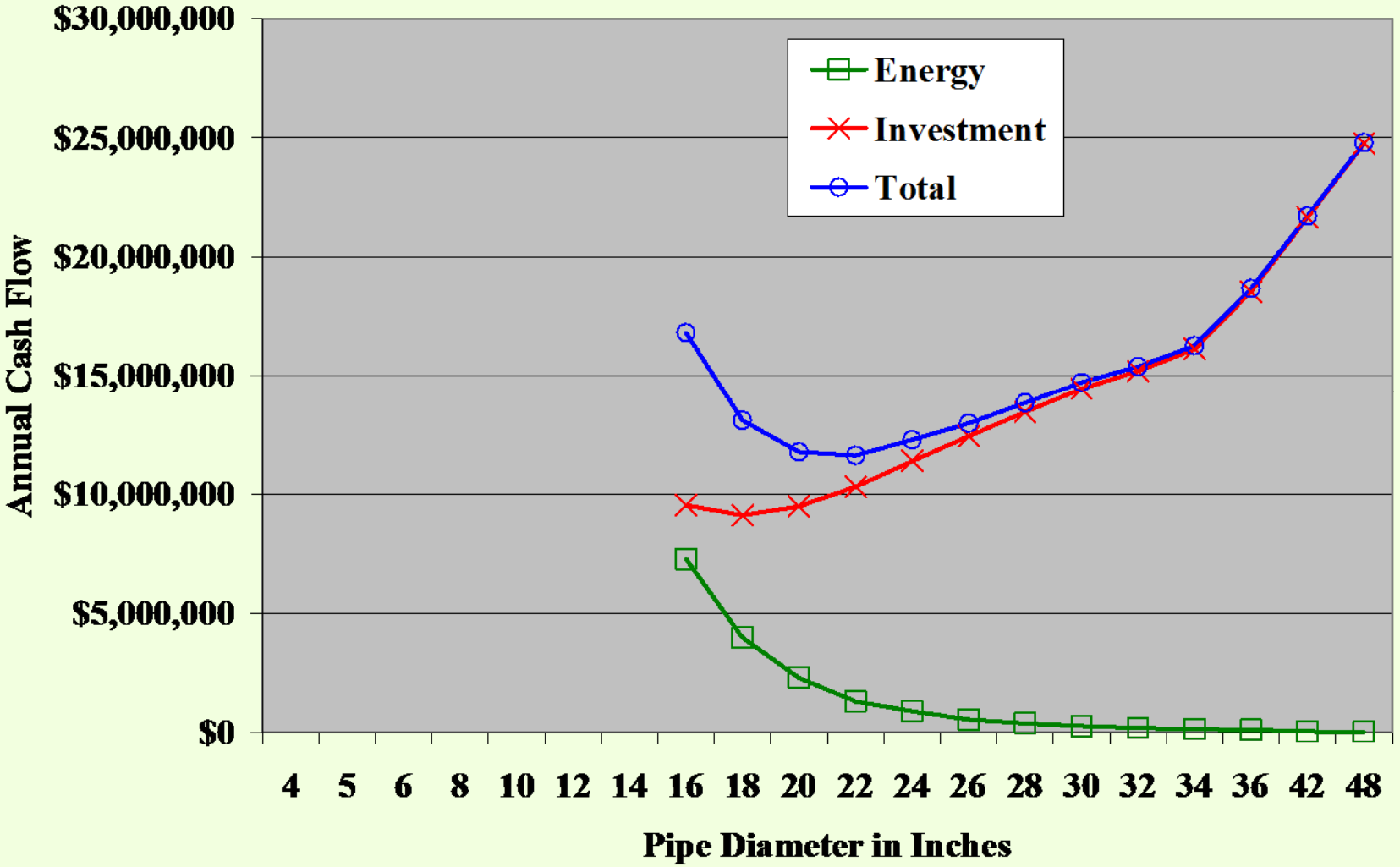

COST-OPTIMIZED
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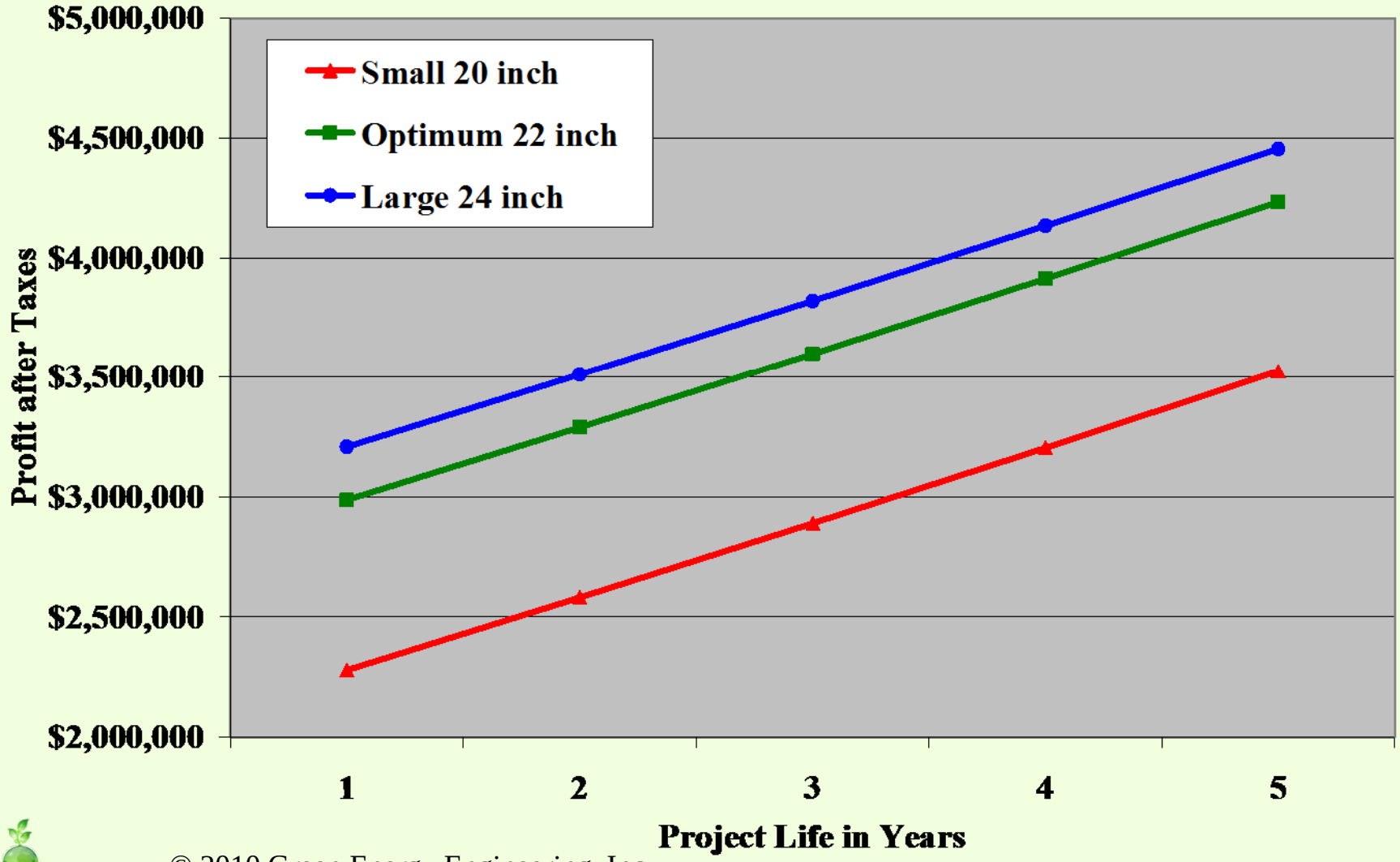
Corporate Profits

Profit vs. Pipe Size for Pumping 13,000 GPM a Distance of 50,000 Feet



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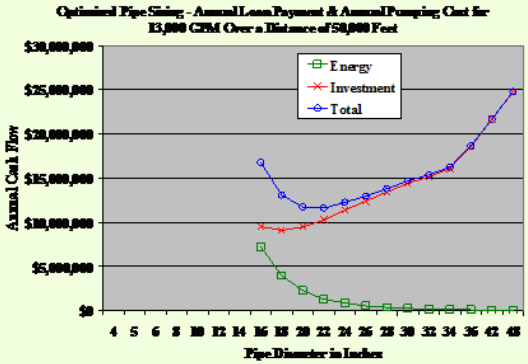

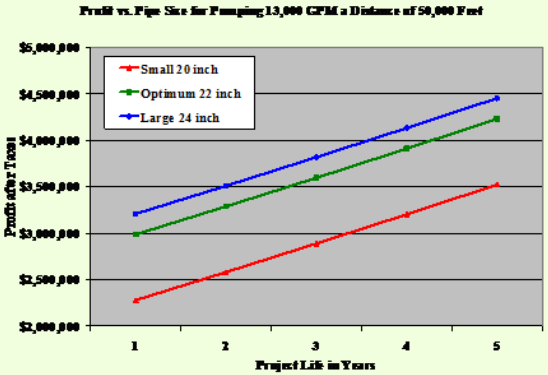

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- **Questions?**