Acid Plant Energy Improvements

Partnering with the Department of Energy to Save Money

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DOE Partners

- Rohm and Haas Deer Park facility partnered with DOE in 1999
  - Pumping systems assessment 1999
    - DOE assessed the entire plant
    - Recommendations on all pumping systems
  - Process Heating Class 2002
    - Introduction to Process Heating Assessment and Survey Tool (PHAST)
  - Pinch Study 2003
    - Rohm and Haas received a DOE grant for a Pinch study of the entire plant
    - Recommendations for all areas of the plant
      - Acid Plant options were utilized in capital project evaluations including a Pre-heater and Furnace replacement
- Allied Partner with US DOE in 2003

Pre-heater and Furnace Replacement

- Capital Project to replace the Furnace and Pre-heater initiated in 2002
- Goals included
  - an overall reduction in energy
  - Increase capacity with little/no additional capital
  - Reduce emissions from the Pre-heater stack
  - Use of best practices in the design

Pre-heater and Furnace Project

- Pinch Study results were used to evaluate options
- PHAST models were developed to predict energy savings
- CFD model was used for the furnace layout

Pinch Study

- What is a Pinch Study?
  - “The pinch technique uses temperature-enthalpy diagrams to characterize the hot and cold streams available for heat transfer. The sum of the hot streams and cold streams in a process are drawn on a diagram from which we determine the "pinch" temperature.”
  - Said simply – Pinch looks for opportunities to heat or cool one process stream with another
  - Pinch doesn’t look at economics

2003 Pinch Study

- Pinch study was done to identify energy opportunities
  - Energy Team developed list for the entire plant
  - Study indicated several inefficiencies in the Acid Plant
    - Project Team formed to explore options
      - Vented steam
      - Pre-heater inefficiencies
      - Waste Heat Boiler inefficiencies (not pursued)

Pinch Study Results at the Acid Plant

- Project team evaluated options for replacing the Pre-heater and Furnace
  - Increase the preheated air temperature to decrease natural gas in the Furnace
  - Reduce the operating temperature in the Furnace

PHAST Model

- PHAST model was developed around areas identified to be large energy savings
  - Preheating air with vented steam
  - Increasing the temperature of preheated air
  - Decreasing the Furnace operating temperature
  - Decreasing the excess air in the Furnace

PHAST Model

- Each option was developed individually
  - Predicted energy savings
- Options were combined and modeled for interactions
  - Pre-heater temperatures and reduction of operating temperature in the Furnace
    - Individually 8% and 3%
    - Combined 9%
- Additional opportunities were also modeled

CFD Model

- Computational Fluid Dynamics (CFD) model was developed
  - To predict Furnace temperature, pressure, residence time and excess air
  - Check geometry and optimal burner placement
- Additional capacity was noticed

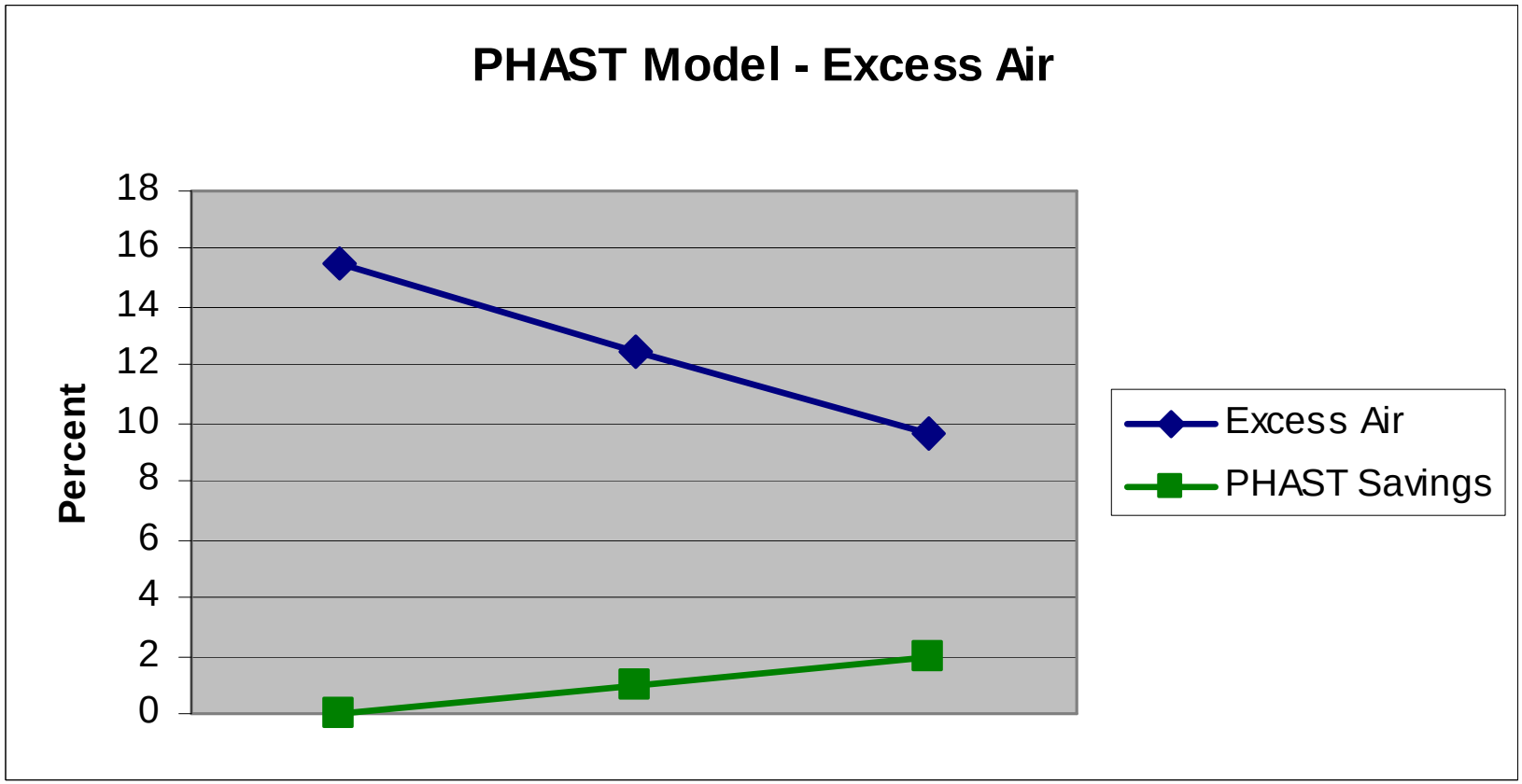
Capacity Increase

- An increase of preheated air temperature decreases the volume of fuel used in the Furnace
- An incremental increase in capacity results
  - Predicted a 5% increase
  - Actual increase is 8%

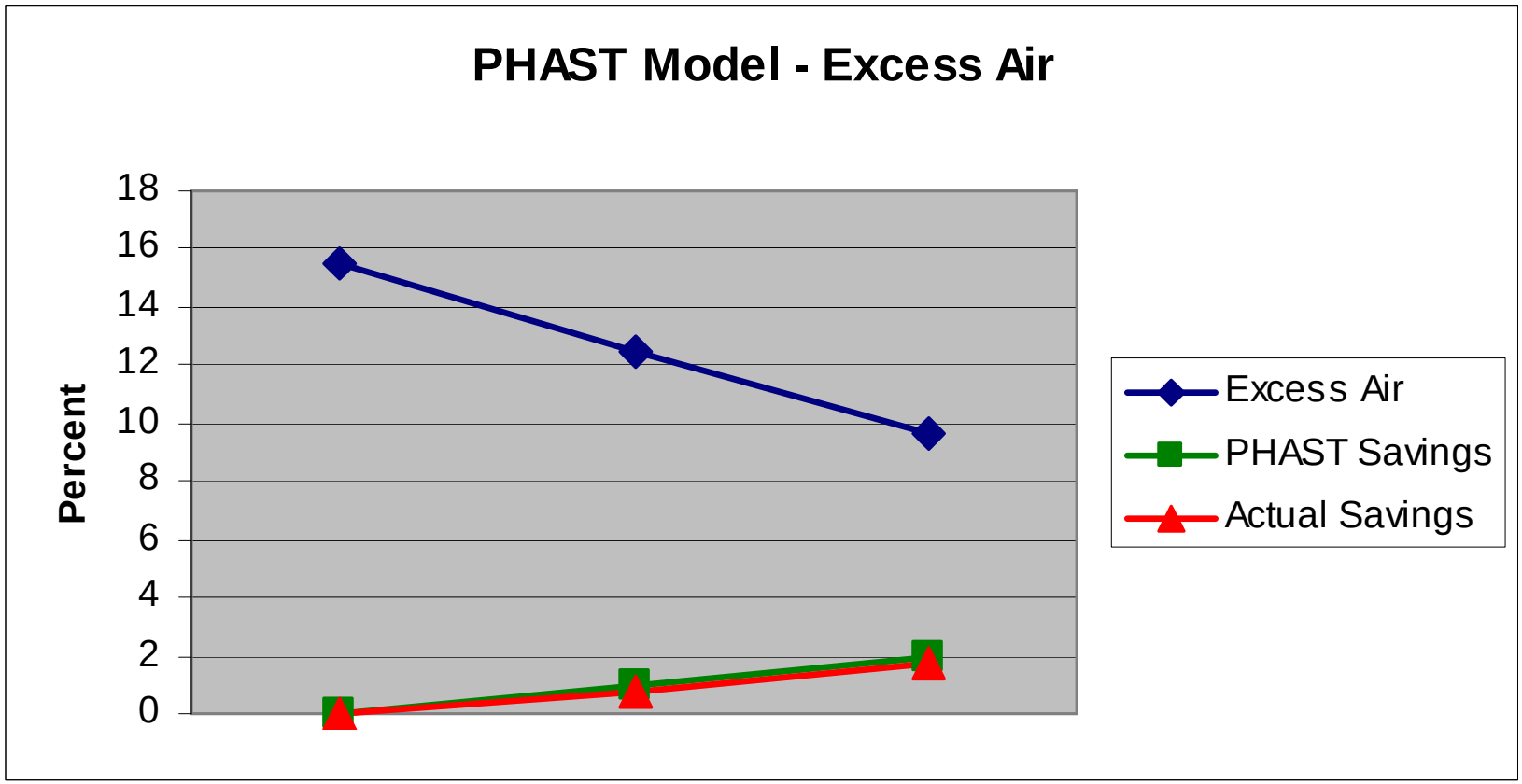
Preheater Energy Evaluation

- 2 opportunities to around the existing Pre-heater
  - Efficiency of Pre-heater
    - Increase of almost 25%
  - Use of vented plant steam for preheat
    - Use of steam to pre-heat process air reduced natural gas usage in the Pre-heater by 22%

PHAST Model Results



PHAST Model Results



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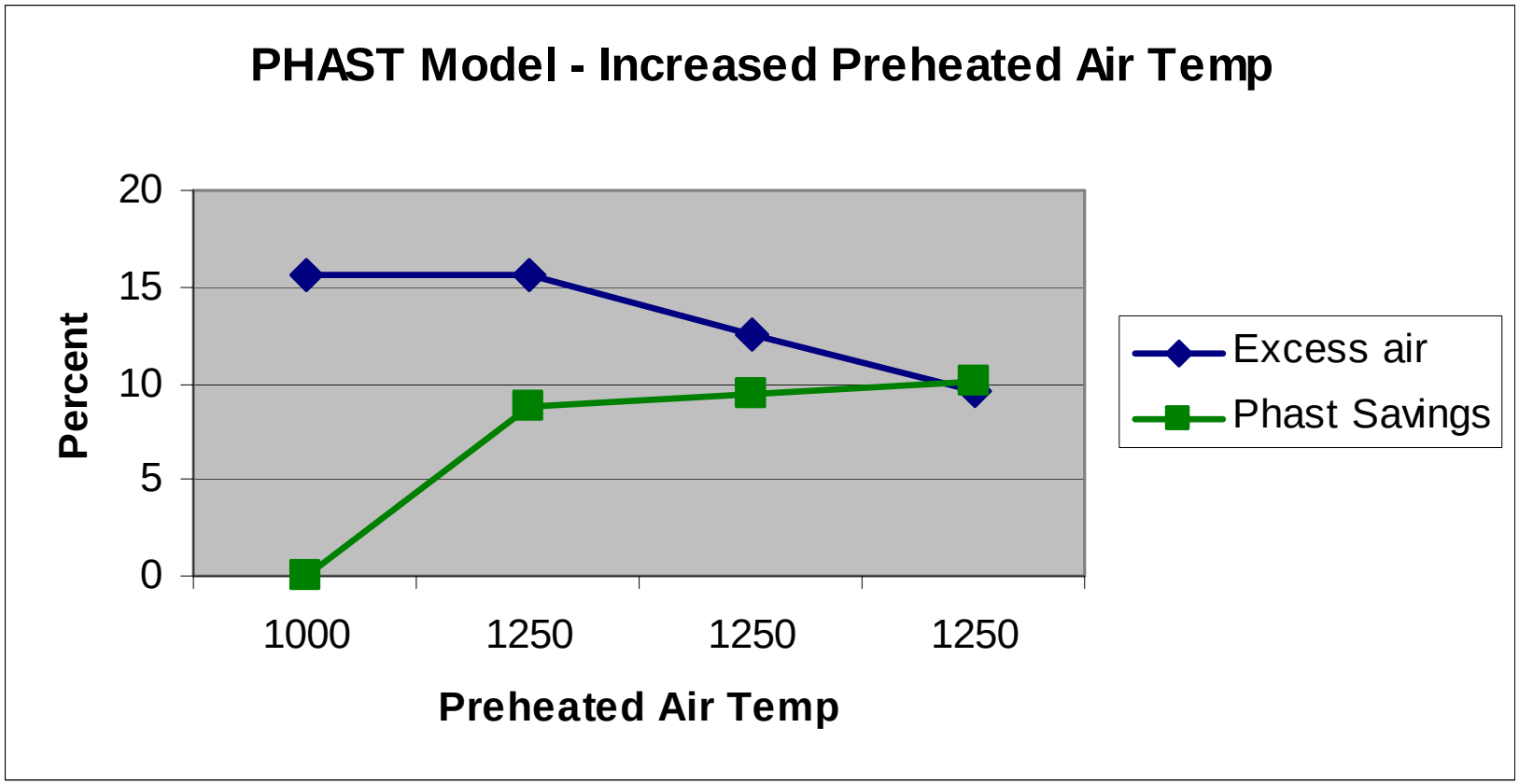

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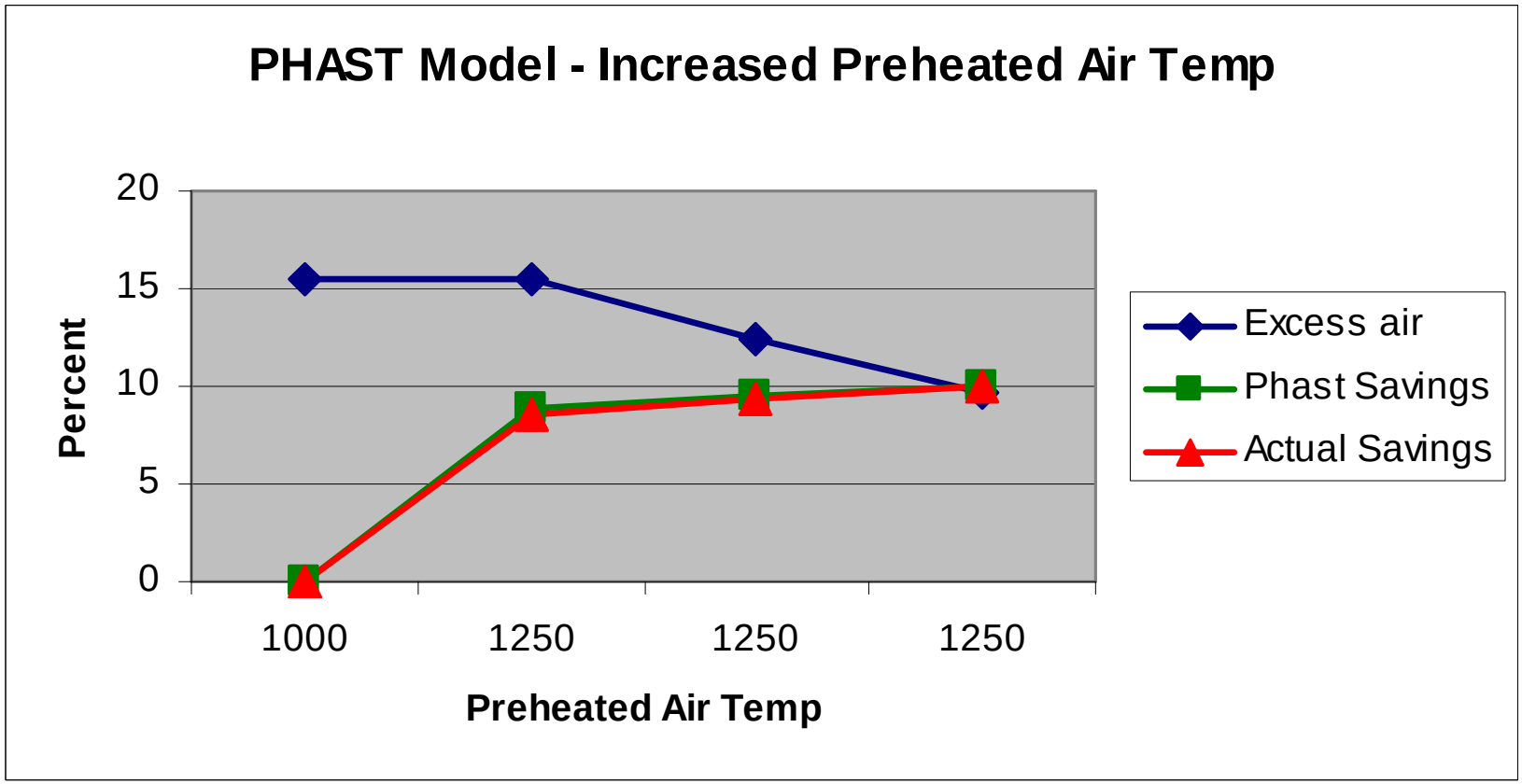

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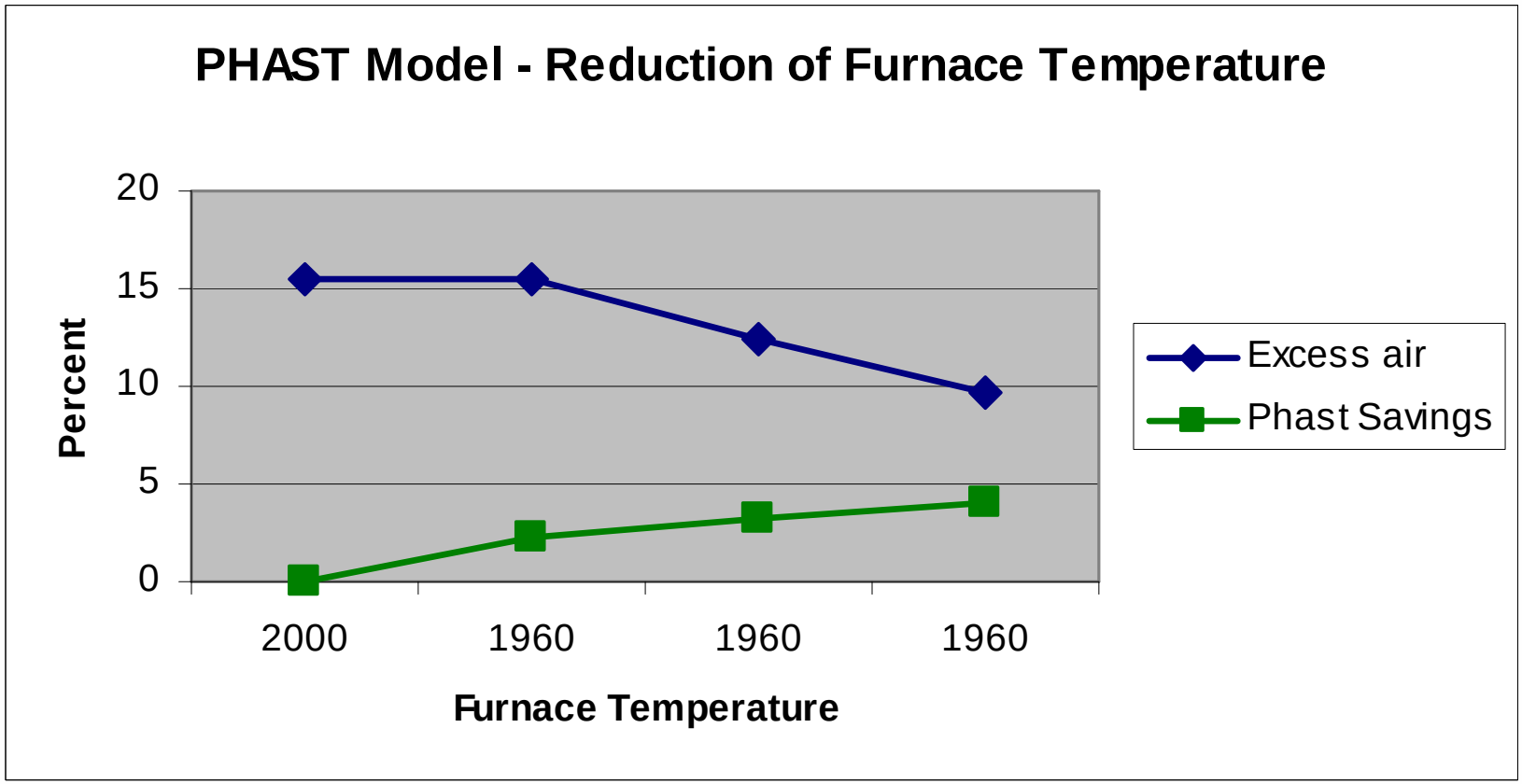

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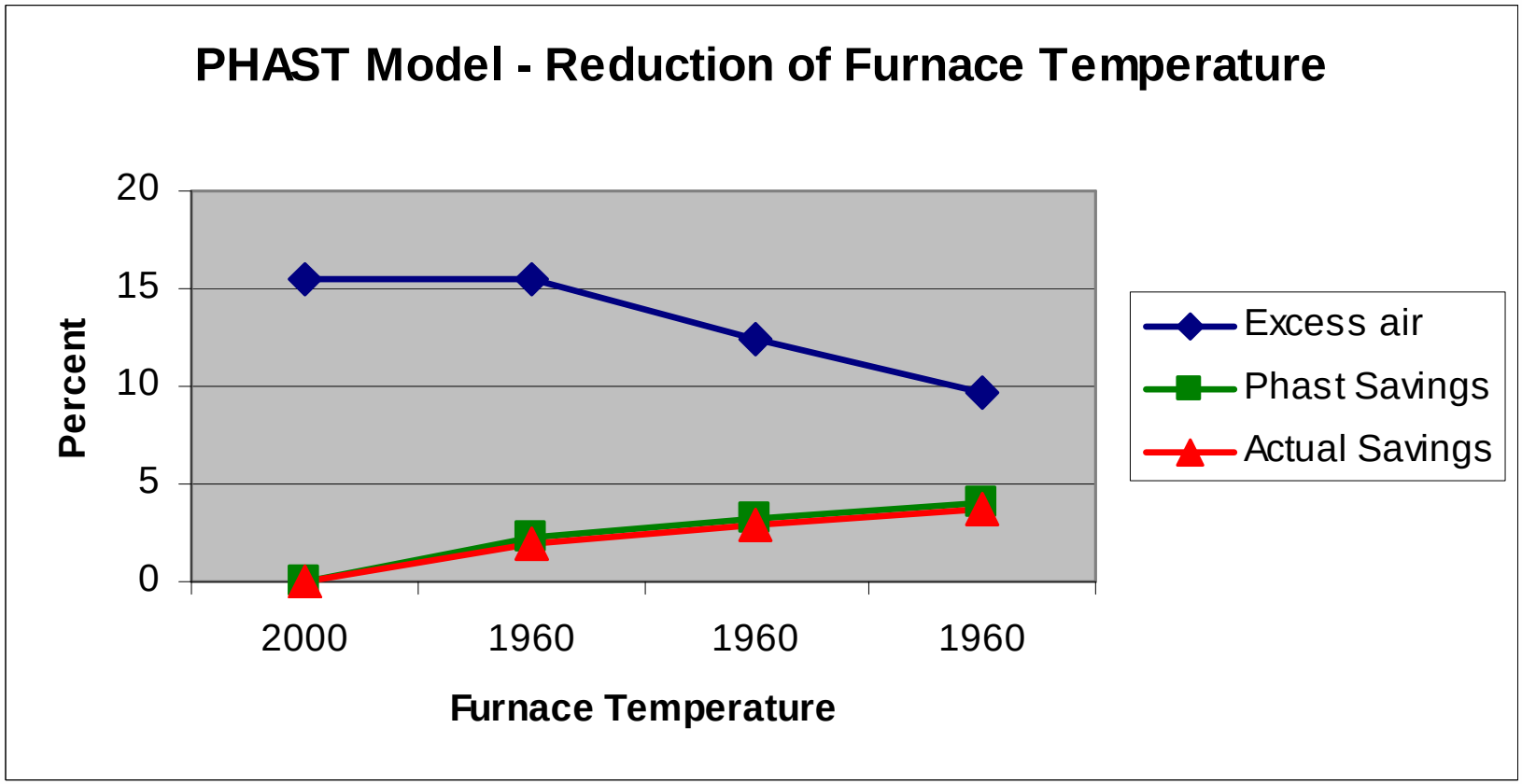

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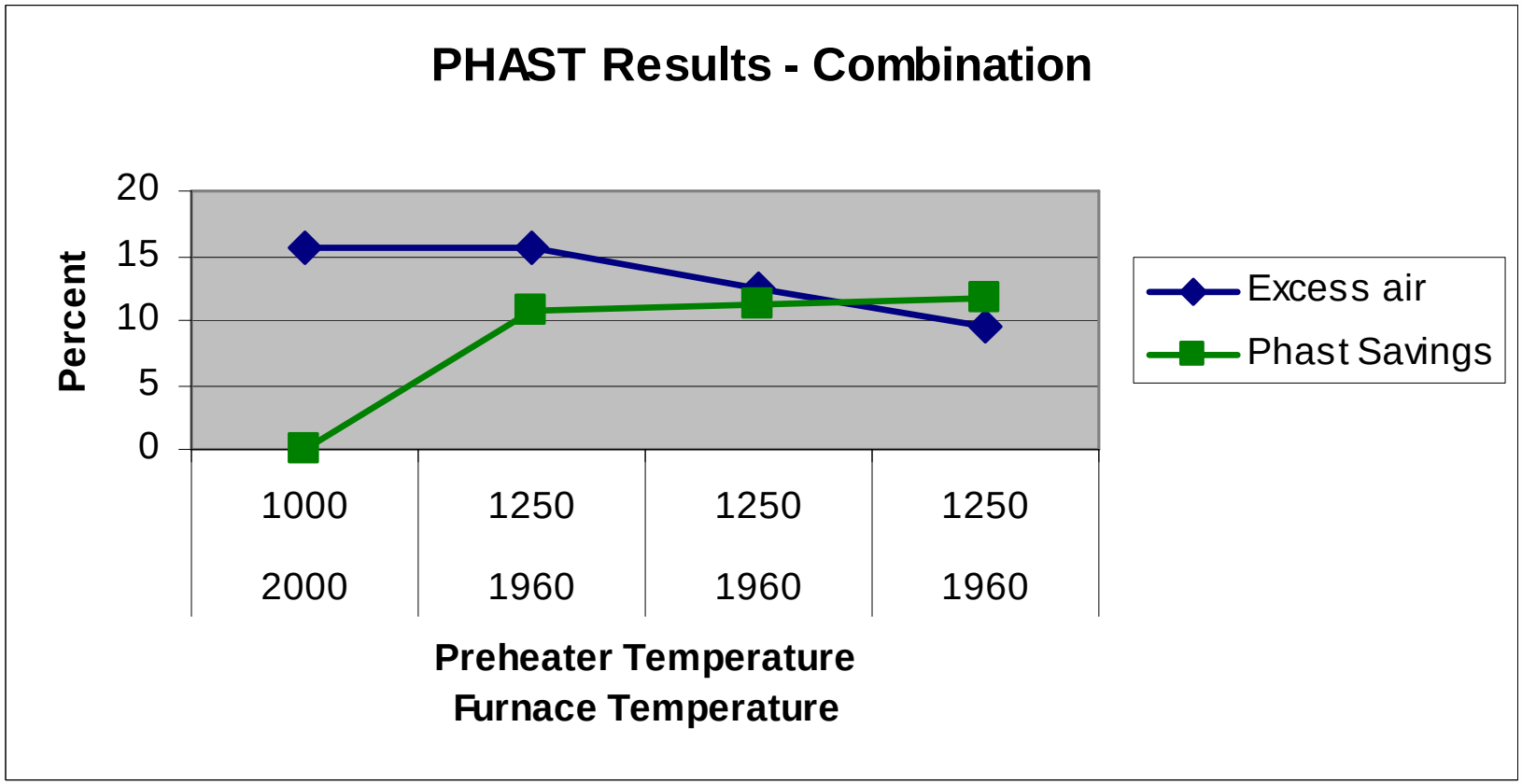

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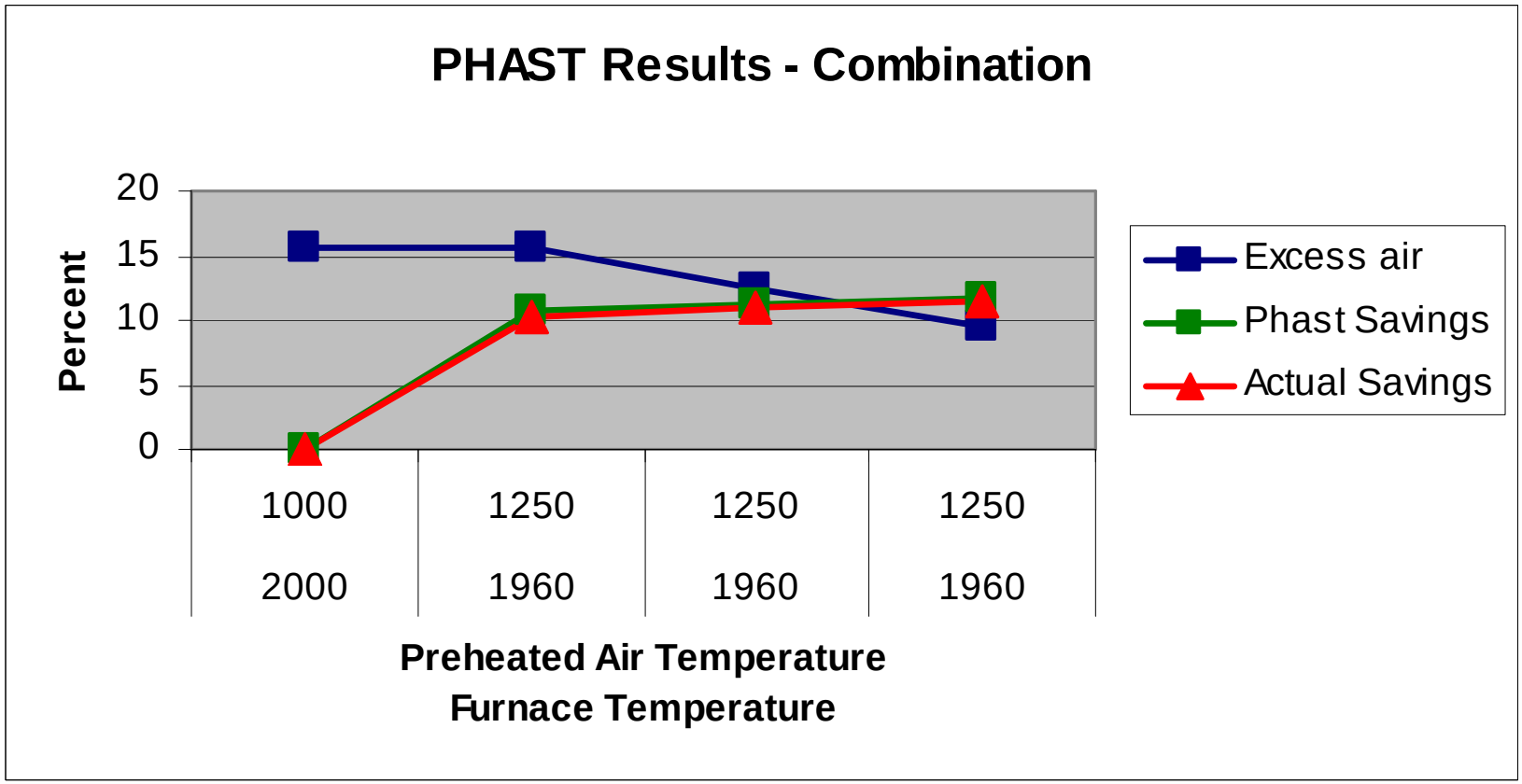

Realized Outcomes

- Pinch, PHAST and CFD models
  - Predict energy savings
- CFD model
  - Estimated capacity increases
- PHAST model
  - Easy to use
  - Accurate energy savings predictions

DOE Information

- DOE has tools and funding for assessments that plants can use to predict energy savings
  - www.eere.energy.gov
  - 877-EERE-INF (337-3463)
  - Case study on this project: www1.eere.energy.gov/industry/bestpractices/pdfs/39276.pdf