Commercial Gas Furnaces – How Cost Effective & Practical?

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Douglas Mahone, HMG

Premise – there are savings

- Large numbers of packaged HVAC
  - Especially small commercial
  - Include gas furnaces (if gas available)
  - High efficiency (condensing) not common
- Gas prices have gone up
- Programs are looking for gas savings
  - lots of effort on cooling side already
  - ~$60 Million in 2006 on programs (per CEE)

Sources of energy savings

- Electronic ignition - save 16% vs. pilot
- Reduce flue losses - damper or blower
- Direct venting w/ preheat - save 9%
- Condensing furnace -
  - save 15%
  - Also reduce CO_2, SOx, NOx

Furnace Types/Terms

- Traditional: 80% efficiency typical
  - Natural draft
  - Fan Assisted draft
    - upstream (forced draft, power burner, etc.)
    - downstream (induced draft, power draft, etc.)
  - Direct vent (sealed combustion)
    - Improve with combustion air pre-heat
- Condensing: 90+% efficiency
  - Recover latent heat (10% of energy)
  - Typically induced draft by fan
  - Improved version: pulse combustion
    - fan used only to start
    - low NOx, SOx

Market Status

- Condensing furnaces
  - Primarily residential applications
  - Not widely available option for packaged HVAC units
  - Limited availability of perhaps 3 units
- Standards
  - generally can meet with non-condensing
  - can take trade-off credit for condensing

When/Where Cost Effective?

- Analysis tool – Gas Furnaces
  Advanced Design Guideline
  New Buildings Institute
- Considers
  - Climate/location (10 cities)
  - Building type (6 nonresidential)
  - Marginal cost of natural gas
  - Life cycle cost economics

Cities/Locations

Miami	200 HDD
San Diego	1256 HDD
Phoenix	1350 HDD
Los Angeles	1458 HDD
Riverside, CA	1861 HDD
Fort Worth	2304 HDD
Atlanta	2991 HDD
San Francisco	3016 HDD
Washington, DC	4707 HDD
Chicago	6536 HDD

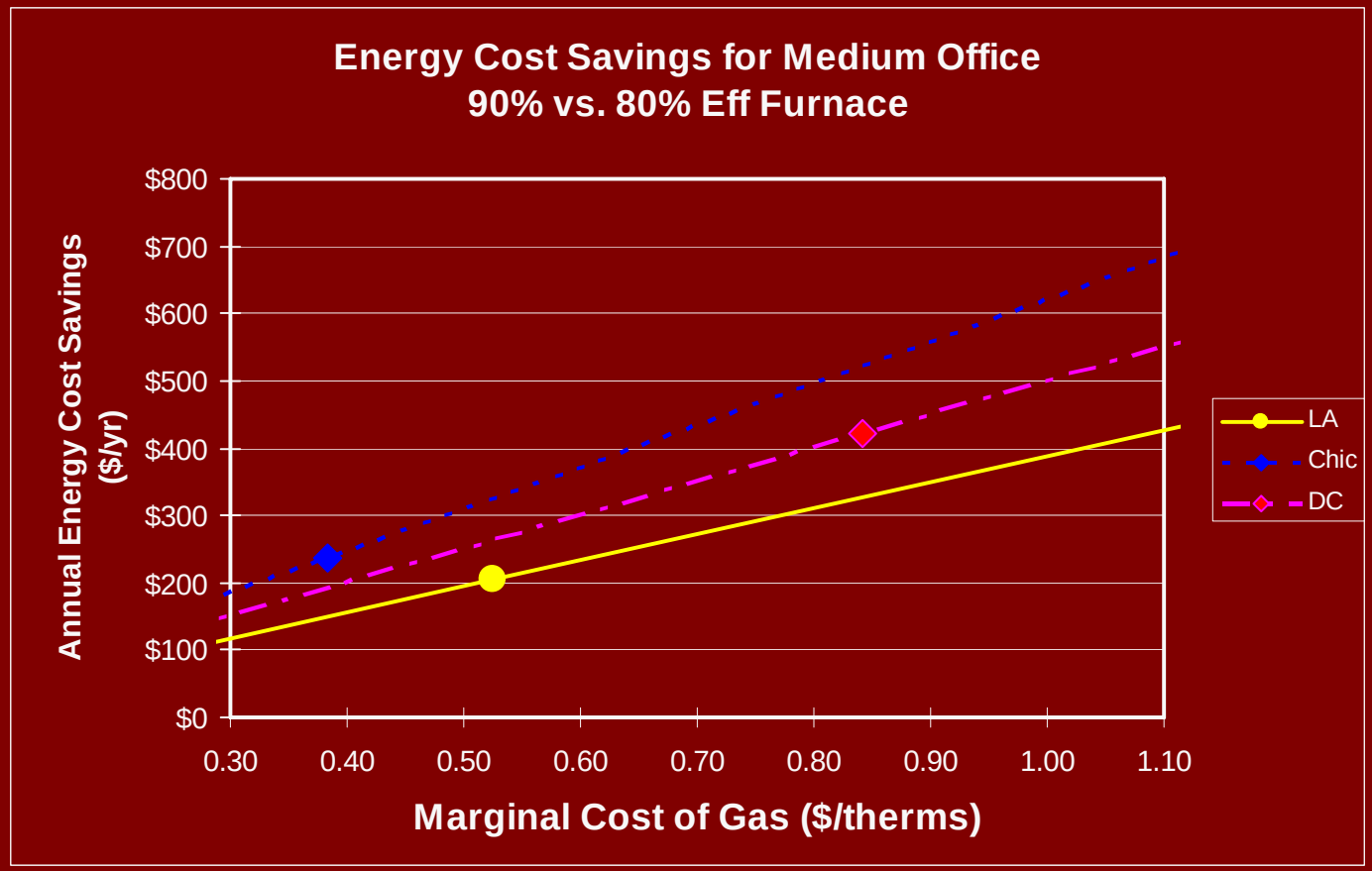
Building Types

Bldg Type	Size (sf)	Capacity (MBH)
Medium Office	49,000	640 – 905
Restaurant	9,060	1,275 – 1,828
Fast Food	2,000	325 – 525
Medical Clinic	49,000	738 – 969
Small Retail	9,600	483 – 799
School	50,000	2,275 – 3,339

Annual Energy Savings

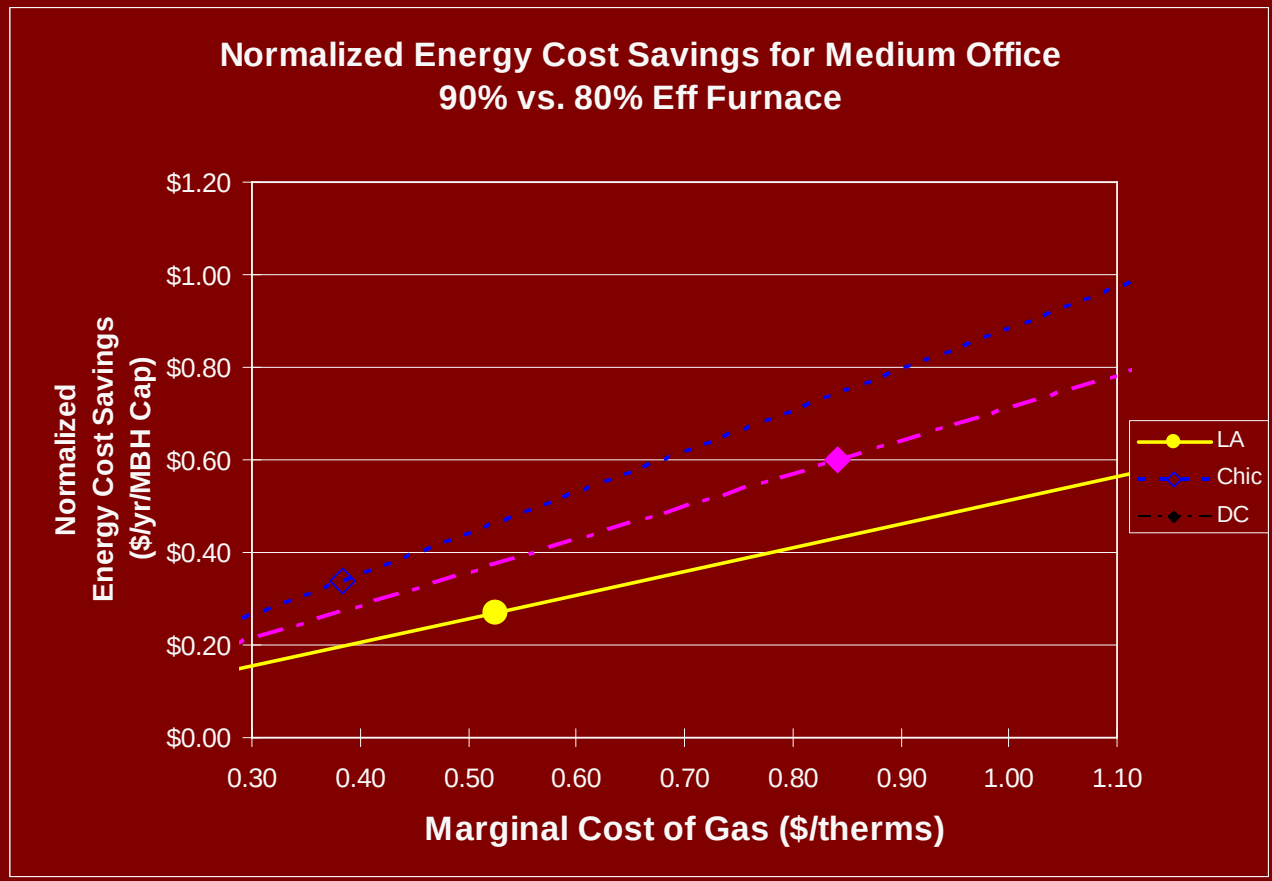
- From standard 80% efficiency to 90% efficiency condensing furnace
  - Annual Energy Cost Savings ($/yr)
  - Normalized Energy Cost Savings ($/yr-MBH Capacity)

Annual Energy Cost Savings



Higher energy costs will yield higher cost savings

Normalized Energy Cost Sav.



Higher energy costs will yield higher cost savings

Cost Effectiveness

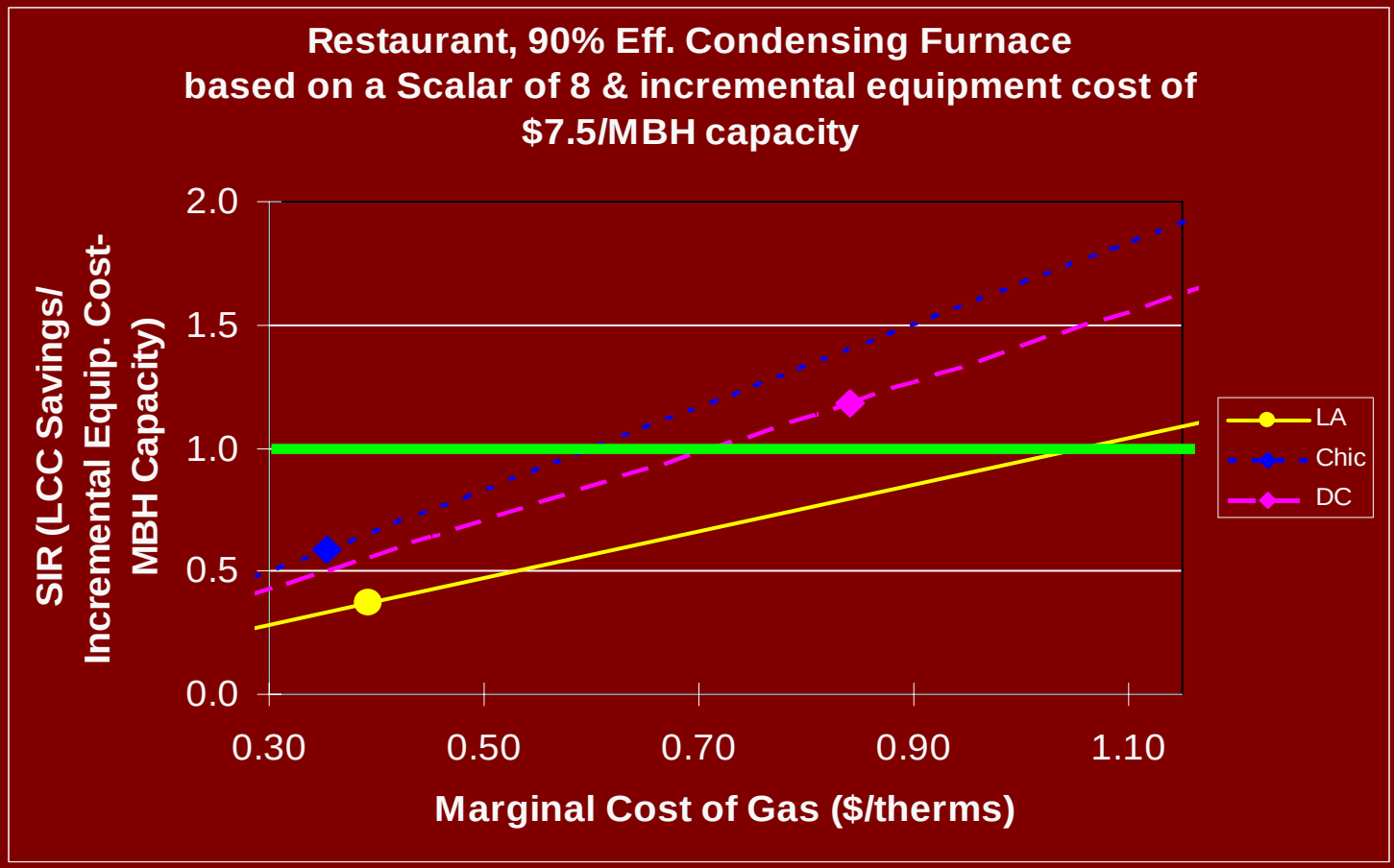
$$SIR = \frac{LCC\ Savings}{Incremental\ Cost}$$

- Savings to Investment Ratio (SIR)
  - Life Cycle Cost Savings ($), divided by
  - Incremental measure cost, per unit of capacity ($/MBH)
- 1st Year Savings
  - building type
  - equipment efficiency
  - climate
  - utility rate
- LCC = 1st Year Savings * Scalar Ratio

Scalar Ratio

- Simplifies LCC analysis
  - Series present worth multiplier
  - Function of:
    - discount rate
    - period of analysis (# of years)
    - fuel escalation rate
- Values of 8, 12, 16 (decreasing discount rate)

Cost Effectiveness Graph



Higher energy costs will improve cost effectiveness

Adjustable Analysis

- Start with building type
  - Pick closest climate city
  - Pick incremental gas cost
  - Pick scalar
- Easily adjusted for:
  - Different incremental costs
  - Different economic criteria (scalar)
  - Different equipment efficiencies
- Extend lines for higher gas costs

Picking the Scalar

- Start with measure life (e.g. 15 yrs)

If increase:	***Then scalar:***
Measure Life	Increases
Discount Rate	Decreases
Energy Cost Escalation Rate	Increases
Maintenance Cost Escalation	Decreases
Inflation Rate	Decreases
Mortgage Interest Rate	Decreases
Tax Advantages	Increases

Observations (eight yrs later)

- Gas costs are higher now
- Tax/utility incentives reduce 1st cost
- Interest rates (discount rate) lower
- Inflation lower
- Technology availability still limited
- Incremental costs may be lower
- More pressure to reduce air pollution
- Pitch: analysis ought to be updated

Where to Get Guidelines

- Gas Furnaces Guideline – Advanced Design Guidelines Series (November, 1998)
- New Buildings Institute
- http://newbuildings.org/guidelines.htm
- Study sponsored by Southern California Gas

Questions/Comments

- Douglas Mahone, Chair
  Principal/Executive Officer
  Heschong Mahone Group, Inc.
- 11626 Fair Oaks Blvd. #302
  Fair Oaks, CA 95628 (Sacramento area)
- (916) 962-7001
  dmahone@h-m-g.com
  www.h-m-g.com