AEO 2004 Efficiency Impacts from Technology

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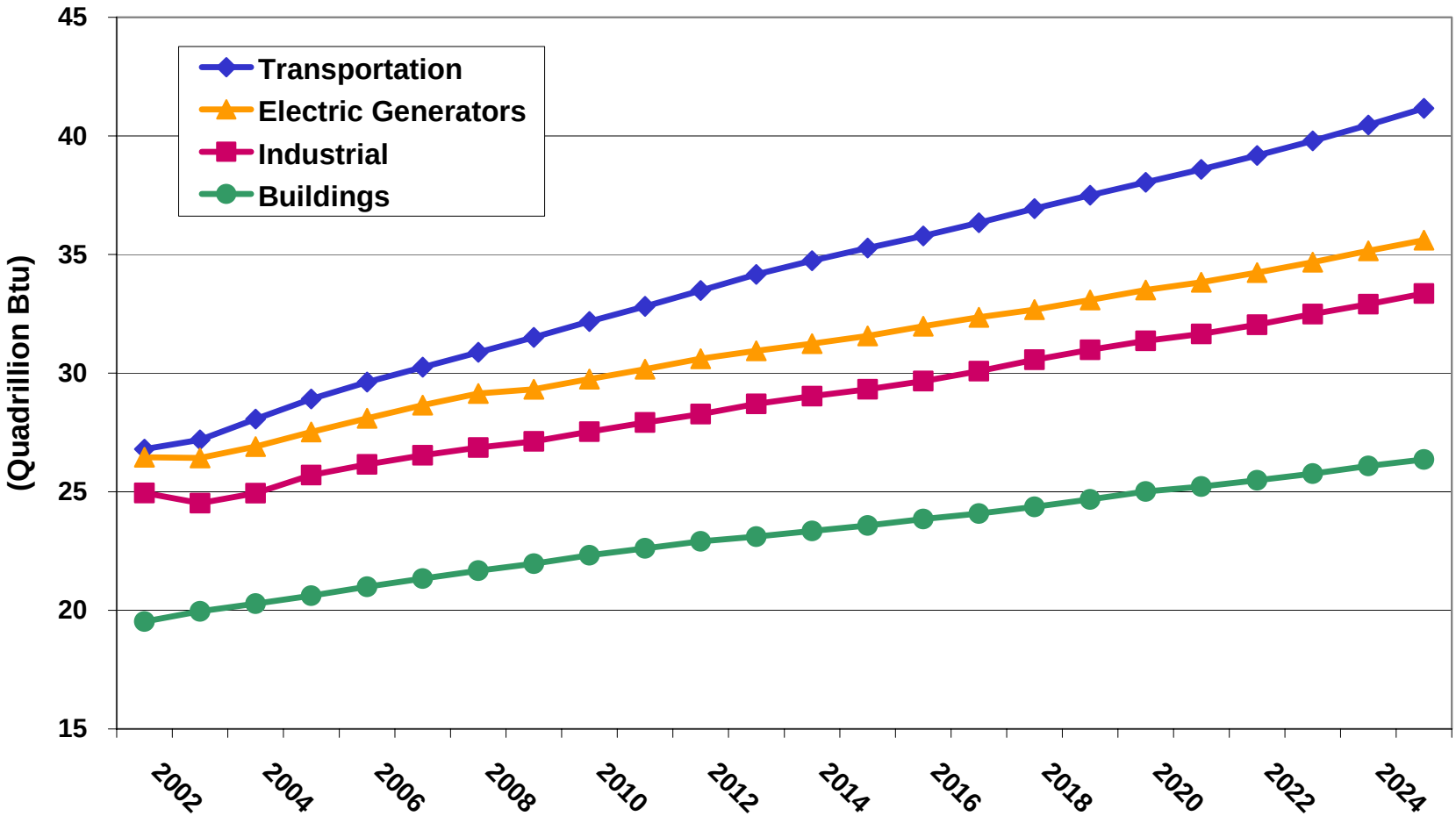
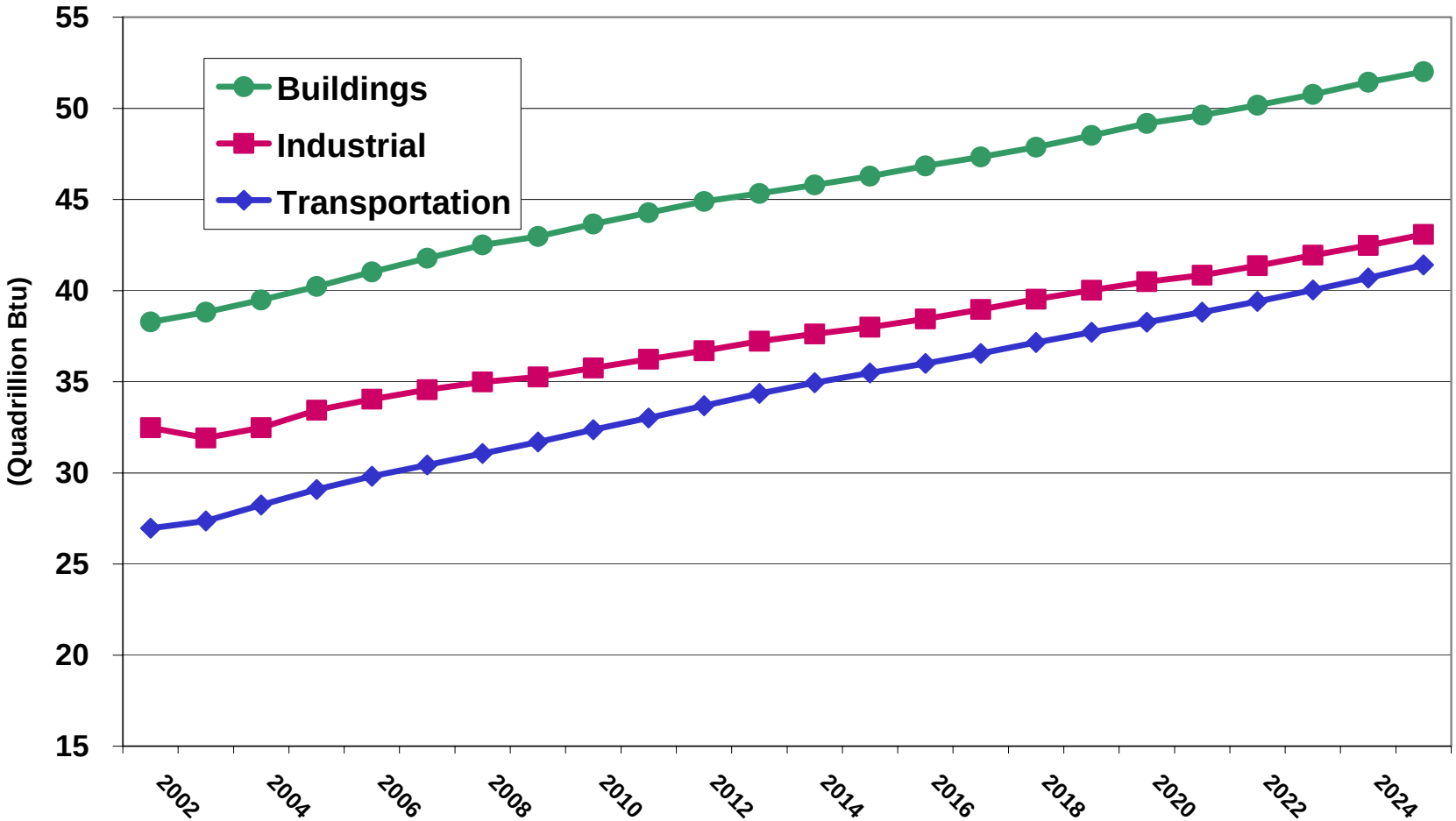
Delivered Versus Primary Energy Consumption

- Delivered energy represents electric energy as measured at the end users' meters and includes electric generation as a sector
- Primary energy allocates energy used in electricity generation, and transmission and distribution energy losses to individual end-use sectors in proportion to delivered electricity
- Transportation is the largest delivered energy consuming sector
- Buildings is the largest primary energy consuming sector, due to its relatively high electricity intensity

Delivered Energy Consumption by Sector
AEO 2004 Reference Case



Primary Energy Consumption by Sector
AEO 2004 Reference Case



Energy Efficiency and Energy Conservation

- Energy Efficiency
  - defined as the ratio of the amount of energy services provided to the amount of energy consumed
    - using less energy for the same level of energy services or getting additional energy services for the same energy are examples of efficiency gains
- Energy Conservation
  - defined as reducing energy consumption through a reduction in the amount of energy services consumed
    - reducing space heating energy consumption by lowering your thermostat is an example of conservation

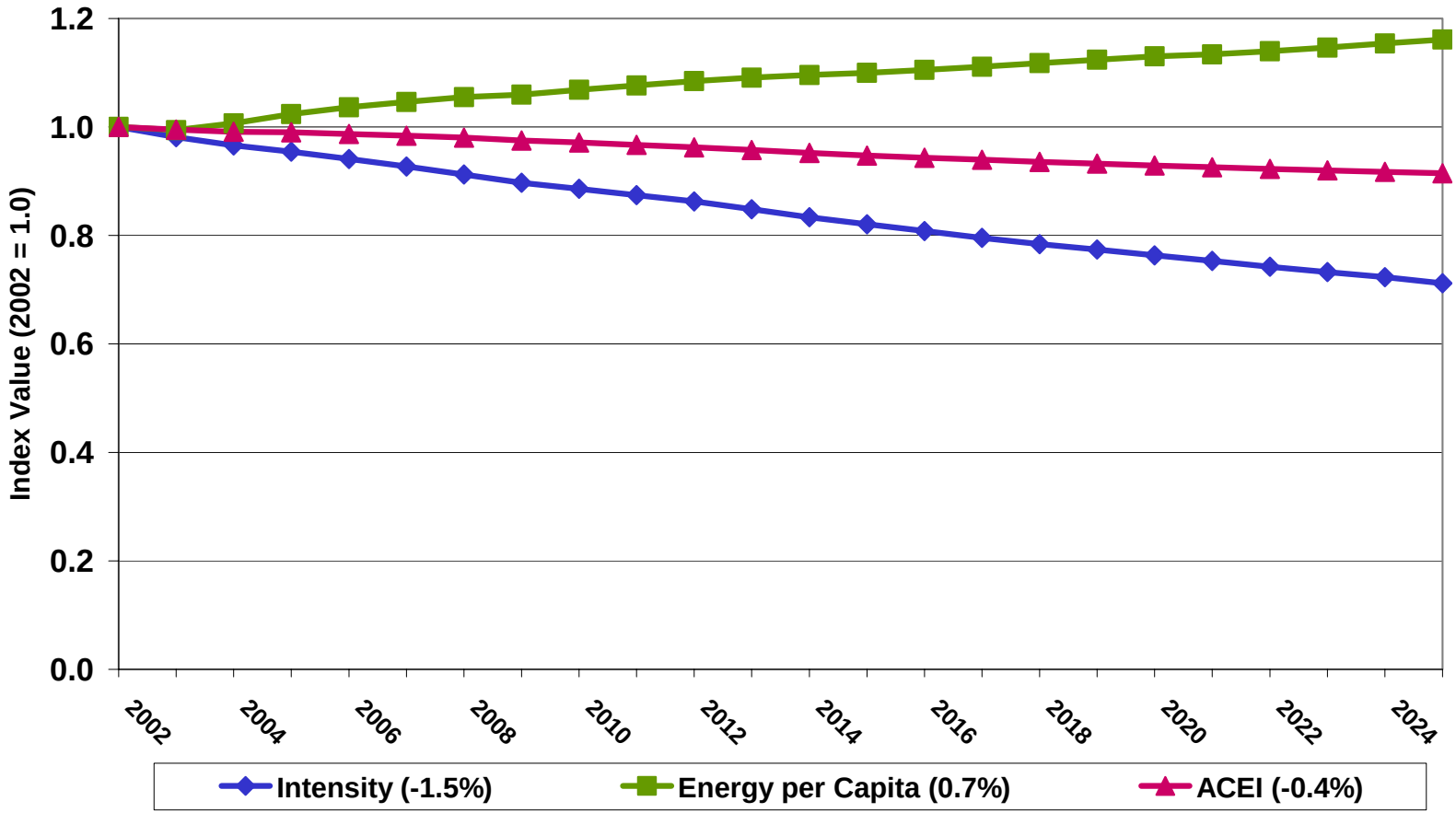
Energy Intensity

- Energy Intensity
  - is measured as the ratio of primary energy consumption to real GDP (E/GDP)
  - includes “structural,” conservation and efficiency effects
  - structural effects examples:
    - general shift in industrial production to less energy intensive industries
    - geographic shifts toward sun belt states affecting buildings energy consumption
    - shift of light duty vehicle stocks to light trucks and away from cars
  - conservation examples:
    - reduced speed limits, moderated thermostat settings, …
  - efficiency examples:
    - efficiency gains due to technology improvements and new technologies
    - minimum efficiency standards (CAFE, EPACT….)

Aggregate Composite Efficiency Index
(ACEI)

- Measures energy efficiency in the AEO projections by index-aggregating end-use efficiencies
- Not calculated for history due to general unavailability of required detail
- Unlike the energy intensity, ACEI will not credit “structural changes” or energy conservation as energy efficiency gains or losses. ACEI removes intensity effects caused by:
    - industry composition change
    - shift from cars to SUVs, Mini-Vans and Trucks
    - building type mix and geographic distribution
    - penetration of end uses like computers and electronics
    - conservation and price-induced (elasticity) changes
    - quality of energy services provided (e.g., TV screen size, SUVs)
    - weather

Comparison of Efficiency and Intensity Measures for the AEO 2004 Reference Case



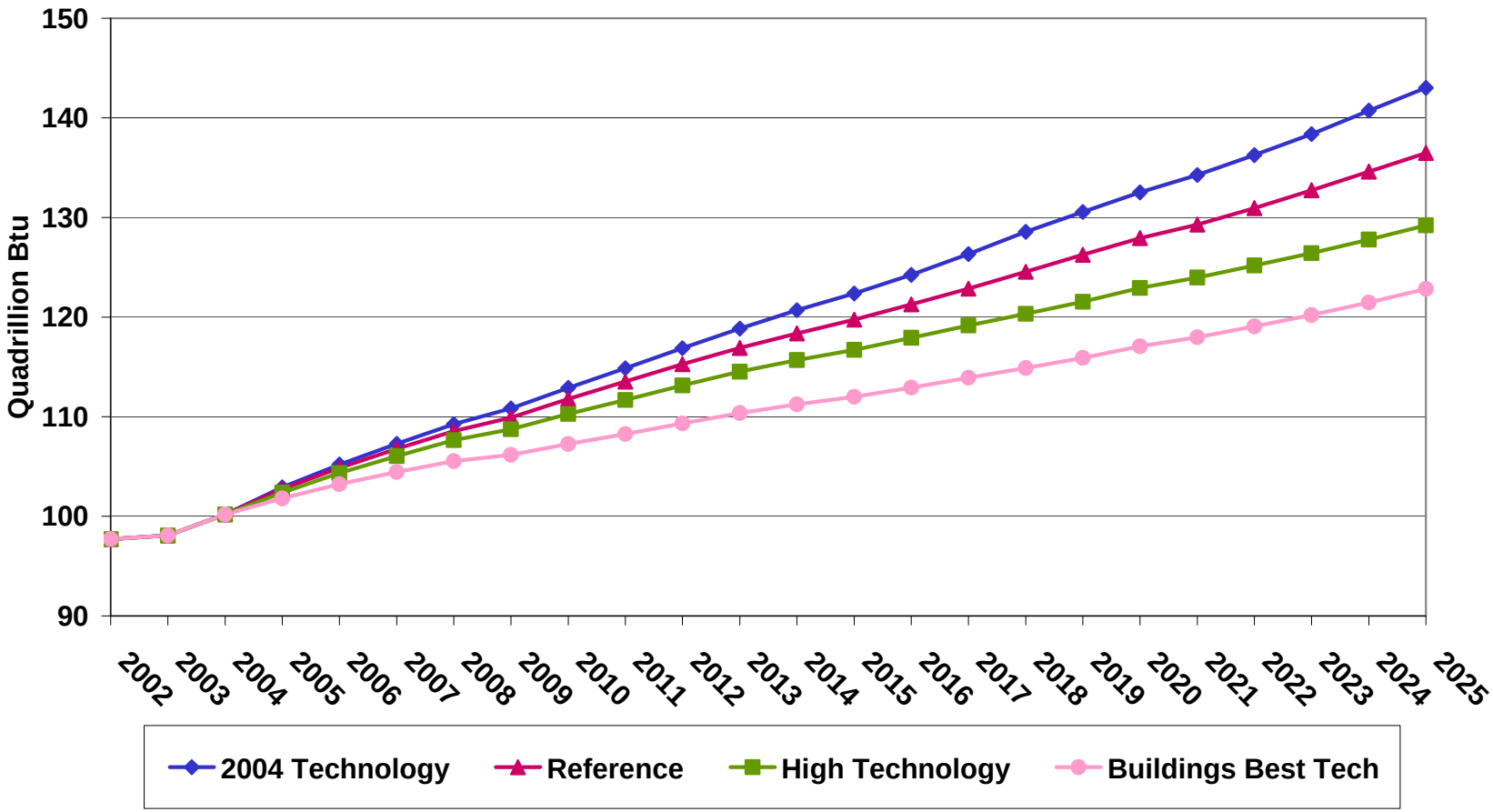
AEO Integrated Efficiency Cases

- 2004 Technology Case – only technologies available in 2004 can be purchased over the forecast horizon
  - efficiency can still increase through stock-turnover as relatively efficient 2004 technologies gain share
- High Technology Case – costs of advanced technologies are lower and/or their projected availability is earlier
  - costs may still limit advanced technology penetration
  - turnover of equipment still limits how fast replacement opportunities to install advanced equipment occur

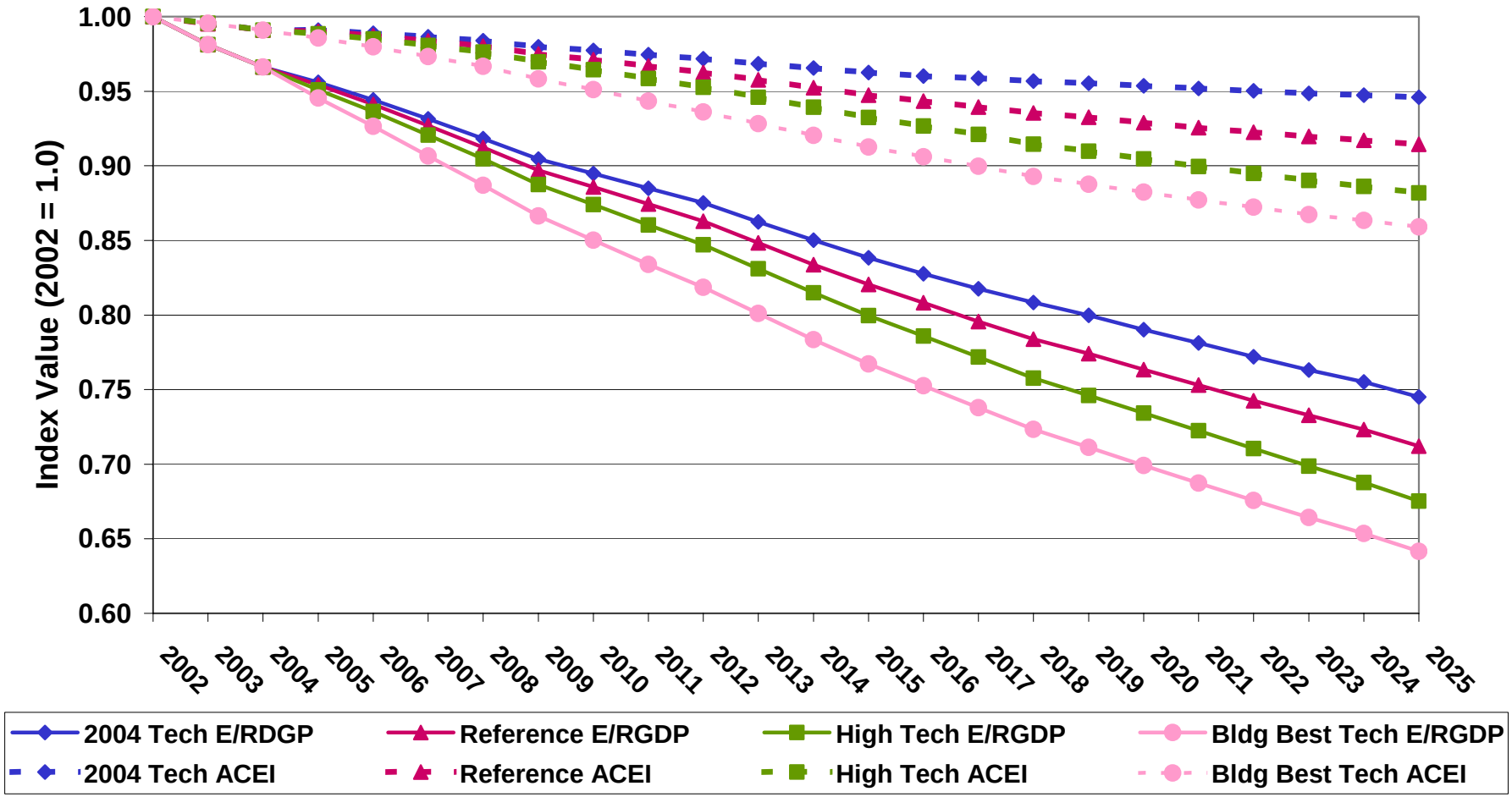
AEO Buildings Best Technology Case

- Non-integrated run based on the High Technology integrated case
- Buildings Best Technology Case assumptions:
  - equipment costs are ignored – only the most efficient technologies available are installed (fuel switching is not allowed)
  - building shells are assumed to become more efficient than in the Reference Case
  - energy consumption for office equipment and miscellaneous uses is assumed to grow slower due to efficiency gains
  - equipment turnover still constrains the speed of penetration of best technologies

Technology Case Primary Energy Consumption Comparisons



Technology Case Efficiency & Intensity Index Comparisons



Growth Rate Summary

2002 to 2025

	Reference Case	2004 Technology Case	High Technology Case	High Tech with Buildings Best Case
Energy Intensity (E/GDP)	-1.5%	-1.3%	-1.7%	-1.9%
Energy Efficiency	-0.4%	-0.2%	-0.5%	-0.7%
Primary Energy Consumption	1.5%	1.7%	1.2%	1.0%

Related EIA Reports

- *EIA, Annual Energy Outlook 2004*, DOE/EIA-0383(2004) (Washington, DC, December 2003), www.eia.doe.gov/oiaf/aeo/index.html
- *EIA, Measuring Energy Efficiency in the United States' Economy: A Beginning*, DOE/EIA-0555(95)/2 (Washington, DC, October 1995); www.eia.doe.gov/emeu/efficiency/contents.html
- Battles, S.J. and Burns, E.M., "United States Energy Usage and Efficiency: Measuring Changes Over Time," Presented at the 17th Congress of the World Energy Council (Houston TX, September 14, 1998), www.eia.doe.gov/emeu/efficiency/wec98.htm
- Wade, S.H., *Measuring Changes in Energy Efficiency for the AEO 2002,* www.eia.doe.gov/oiaf/analysispaper/efficiency/index.html