

Buildings, Commissioning, Efficiency, Comfort, and CO2

Asian Pacific Building Commissioning Conference

ICEBO

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Shenzhen, China

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Commissioning New Buildings

Beginnings

Building Handover Equation

Competitive pressures +

Engineering fee structures +

Financial pressure to occupy quickly

= Building With Minimal

Contact between designers and operators Functional
testing of systems

Documentation

Training for operators

= Building Horror Stories

Commissioning New Buildings

Beginnings

Building Handover Equation led to:

Beginnings of Commissioning – 1980s

“I don’t want any more new buildings. I only want more three-year old buildings where the problems have already been fixed.”

1990s Facility Manager

Commissioning New Buildings

Definition

Cost and Comfort Issues led to

“Commissioning is the process of ensuring systems are designed, installed, functionally tested, and operated in conformance with the design intent.”

ASHRAE Guideline 1 - 1996

Commissioning Existing Buildings

Beginnings

Operating Cost the major driver

Comfort Issues – secondary

Precursors:

1970s energy audits

Dubin-Bloome energy management
recommendations

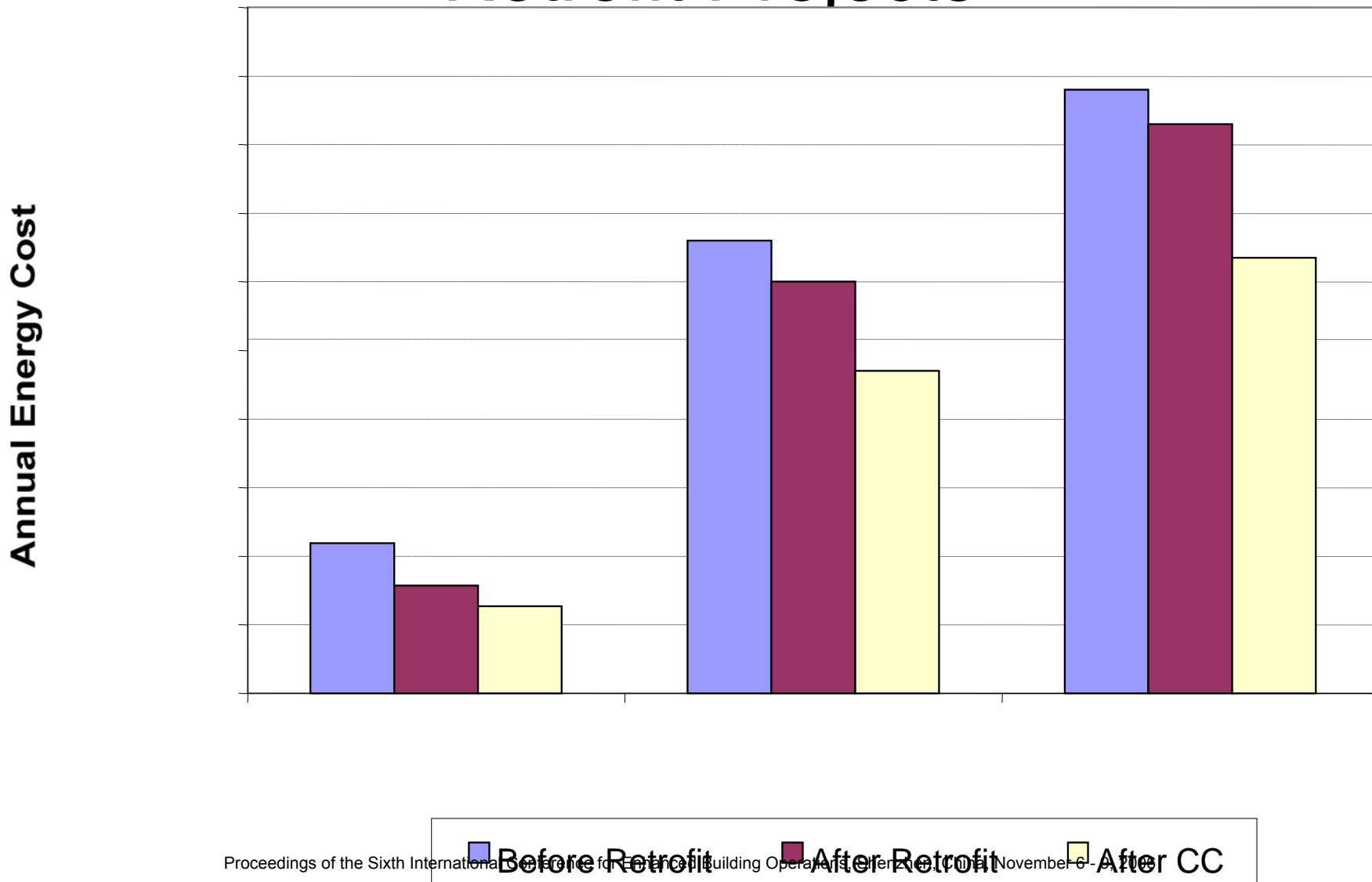
Commissioning Existing Buildings

Personal Beginnings

- University of Colorado Student Recreation Center – 1986
 - 30% energy savings (1983 retrofits)
 - Additional 25% savings from more energy measurement and analysis



Continuous Commissioning[®] Started with Retrofit Projects



Commissioning “New” Existing Buildings
Capitol Extension Building
(Texas Capitol Building in background)



Commissioning “New” Existing Buildings

Capitol Extension Building

- Built in 1992
 - Most energy efficient Texas State office building
 - CC resolved comfort problems
 - Reduced total energy cost by 27%
 - Reduced cooling by 75%
 - Reduced heating by 37%

Commissioning Existing Buildings

Current Processes

- Retro Commissioning
- Recommissioning
- Continuous Commissioning®
- On Going Commissioning
- Continuous Commissioning® (CC®) is an ongoing process to resolve operating problems, improve comfort, optimize energy use and identify retrofits for existing commercial and institutional buildings and central plant facilities. It includes the entire commissioning process from assessment through implementation and subsequent follow-up as necessary.

Continuous commissioning and CC are registered trademarks of the Texas
Engineering Experiment Station

Commissioning of Existing Buildings

Major International Activities

- IEA Annex 40 “Commissioning of Buildings and HVAC Systems for Improved Energy Performance
- IEA Annex 47 “Cost Effective Commissioning for Existing and Low Energy Buildings”

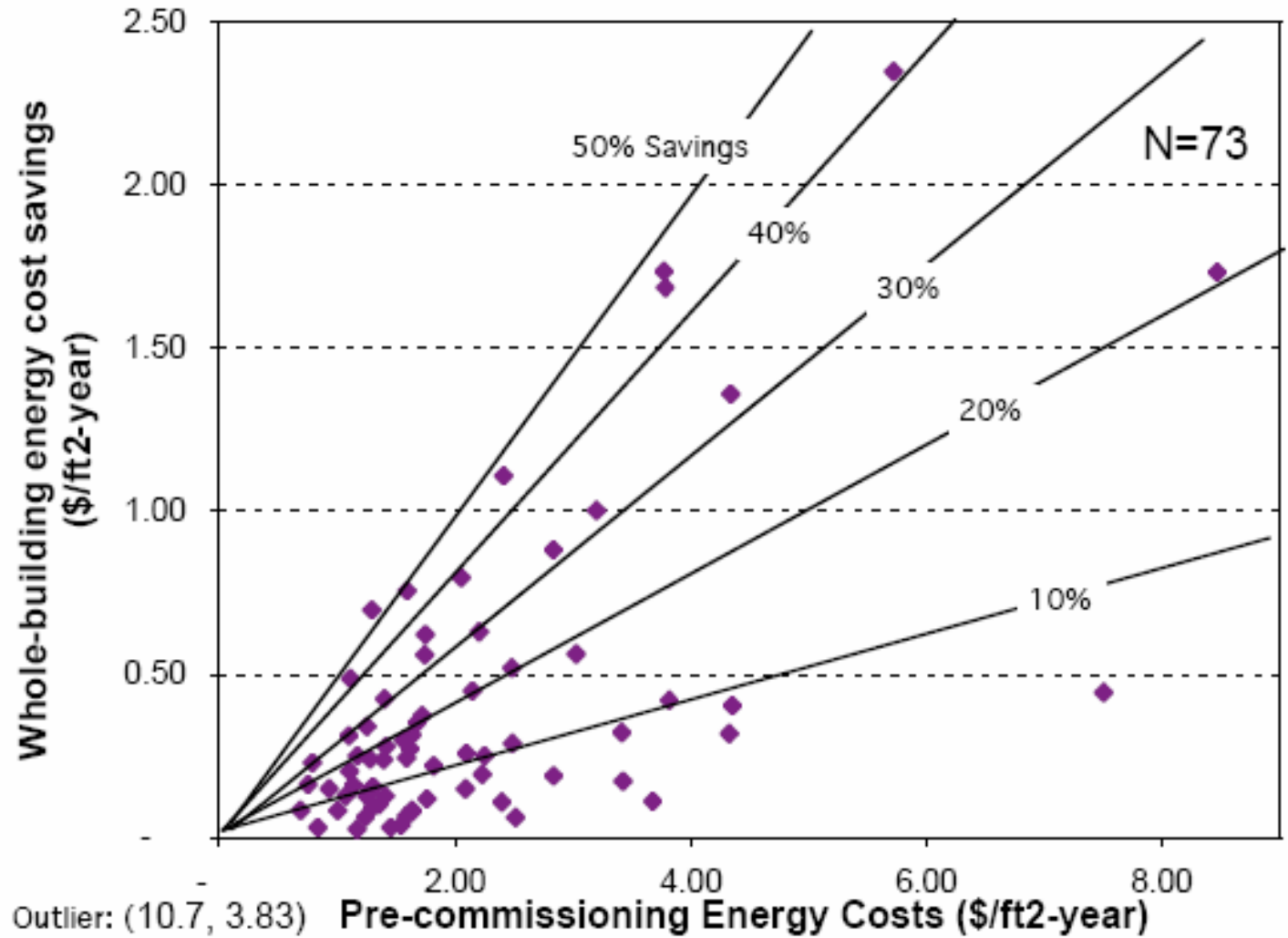
Commissioning of Existing Buildings

International Examples

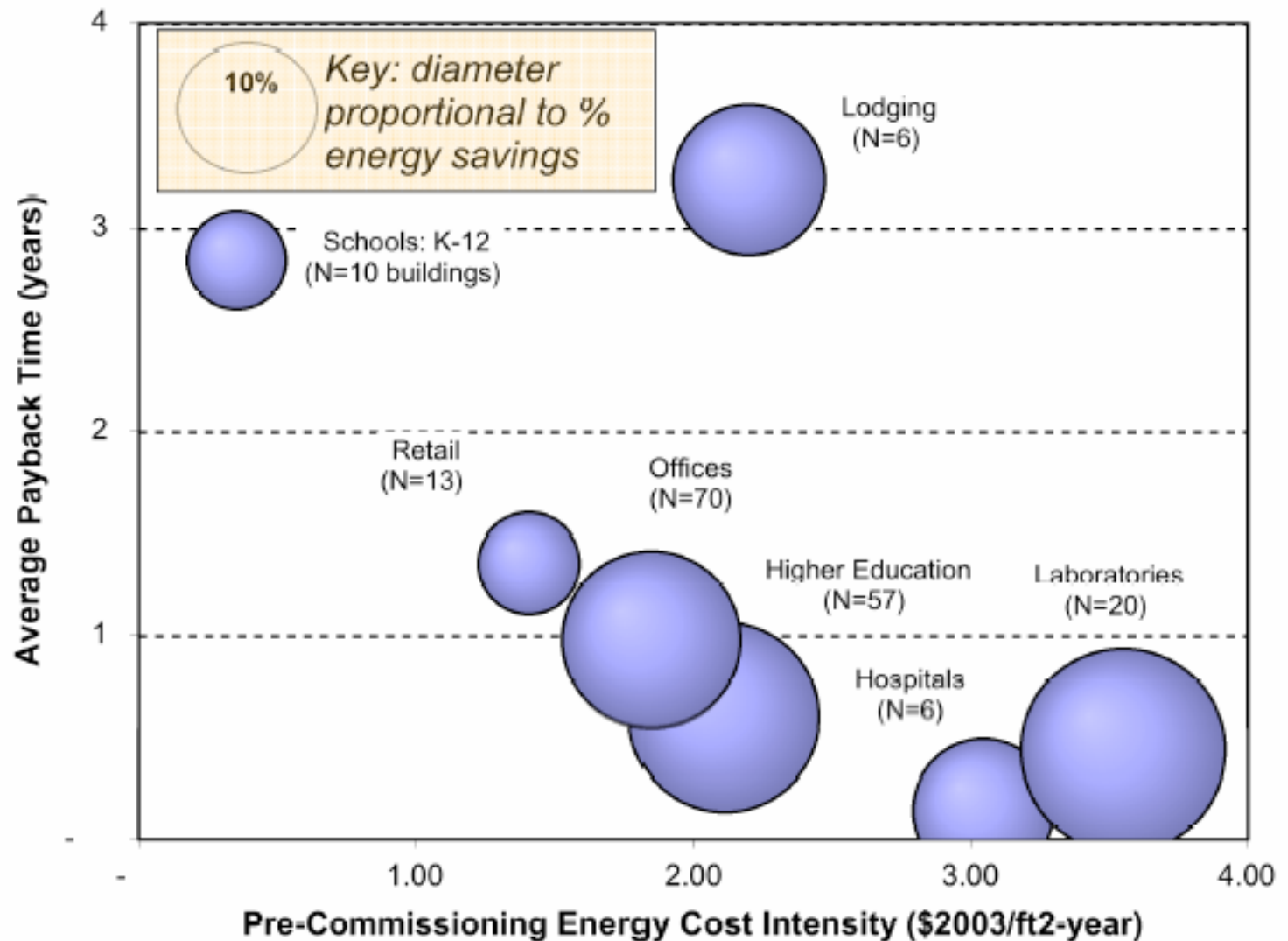
- China – to be added
- Belgium – to be added
- Japan – Akashi et al.



Fig 17. Energy Cost Savings: Existing Buildings
 (median savings 15%; average savings 18%)



Source: M



Source: Mi

Existing buildings. (Excluding non-energy impacts).

Commissioning of Existing Buildings

Impact Today

- Estimate 20 – 40 million m² commissioned in U.S.
- \$45 - \$90 million/yr savings (\$102B energy US comm bldgs - 2003)
- 0.45 – 0.9 million MT/yr CO₂ vs US level of 6B MT/yr

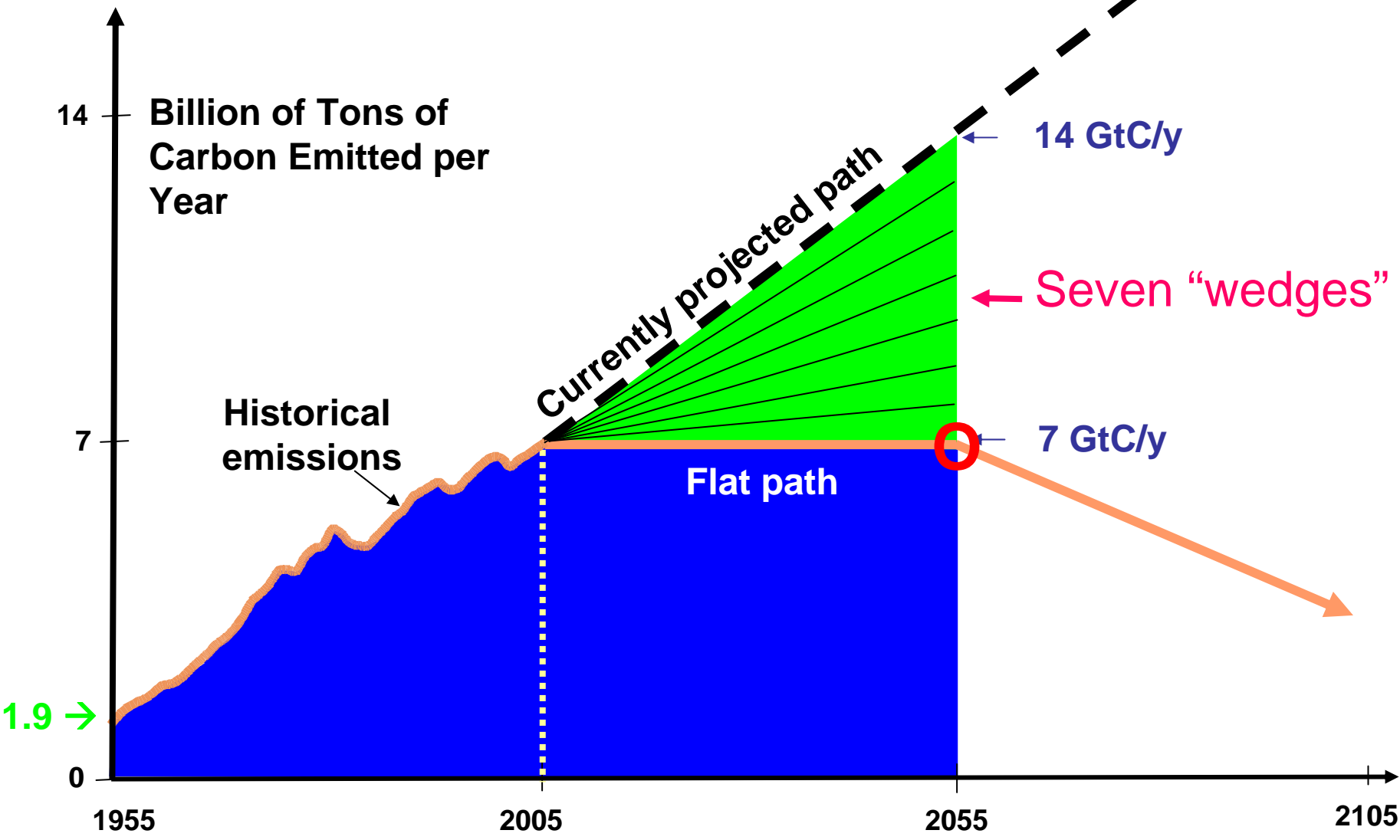
Commissioning of Existing Buildings

Potential Impact

- Potential savings in U.S. Bldgs \$15B/yr or 150 million MT/yr CO₂ (0.6% of world CO₂ emissions)
- US commercial sector use ~50% of world commercial use
- Asia today 10-20% of world commercial use

Wedges

ESL-IC-06-11-322



Source: Socolow 2006 Proceedings of the Sixth International Conference for Enhanced Building Operations, Shenzhen, China, November 6 - 9, 2006



Commissioning of Existing and New Buildings

Future Potential Impact

- Assume world commercial sector develops to $\frac{1}{2}$ current US use per person and 10B people
- \$250B/yr potential energy savings
- 2.5 billion MT potential CO₂ savings (~2/3 of a carbon wedge)