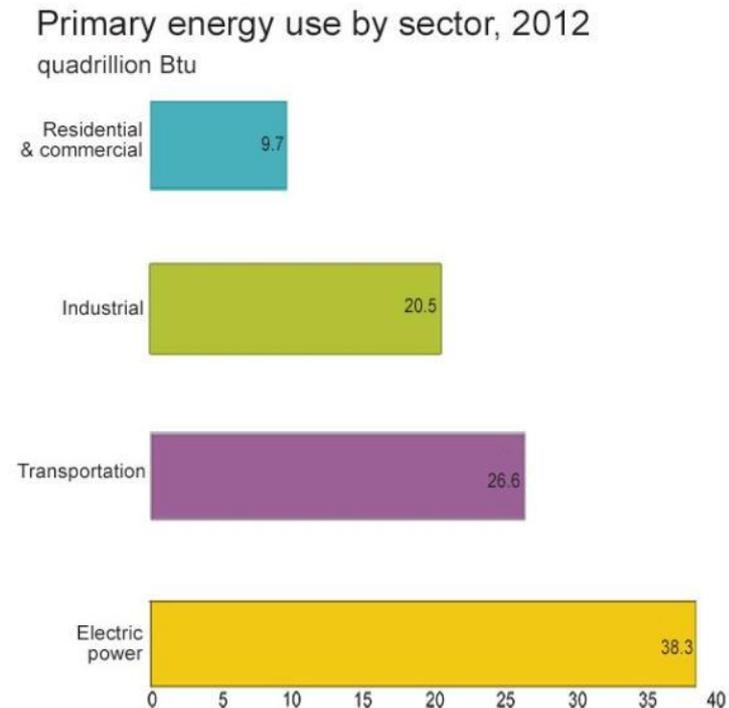


Motivation for Existing Building Focus

- Buildings (and their human occupants) account for 40% of total energy in the U.S., 71% of electricity (EIA 2013, 2014) and 38% of GHG emissions (US EIA, 2008)
- Energy use in the commercial building sector is growing at a rate of 2.9% a year, faster than any other sector of the economy (EIA, 2003 Office Report)
- Adoption of energy innovations have not kept pace with rising energy use (Andrews and Krogmann, 2009)

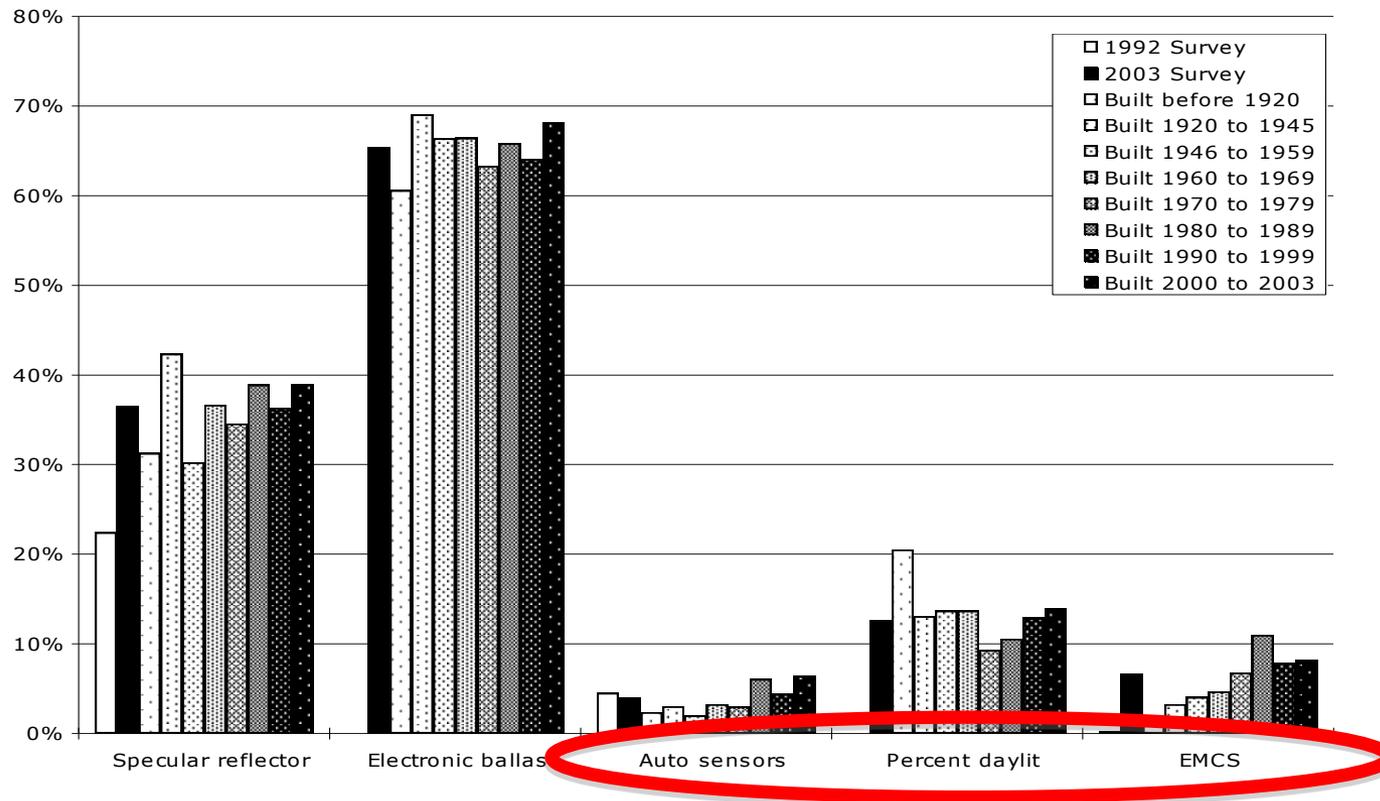
The Role of Existing Buildings

- Building operations consume approximately 50% of the country's annual energy usage (EIA, 2012)
- Existing buildings: long lifespan, slow turnover
- Adoption of energy innovations have not kept pace with rising energy use (Andrews and Krogmann, 2009)



Source: U.S. Energy Information Administration, *Monthly Energy Review*, Table 2.1 (April 2013), preliminary 2012 data.

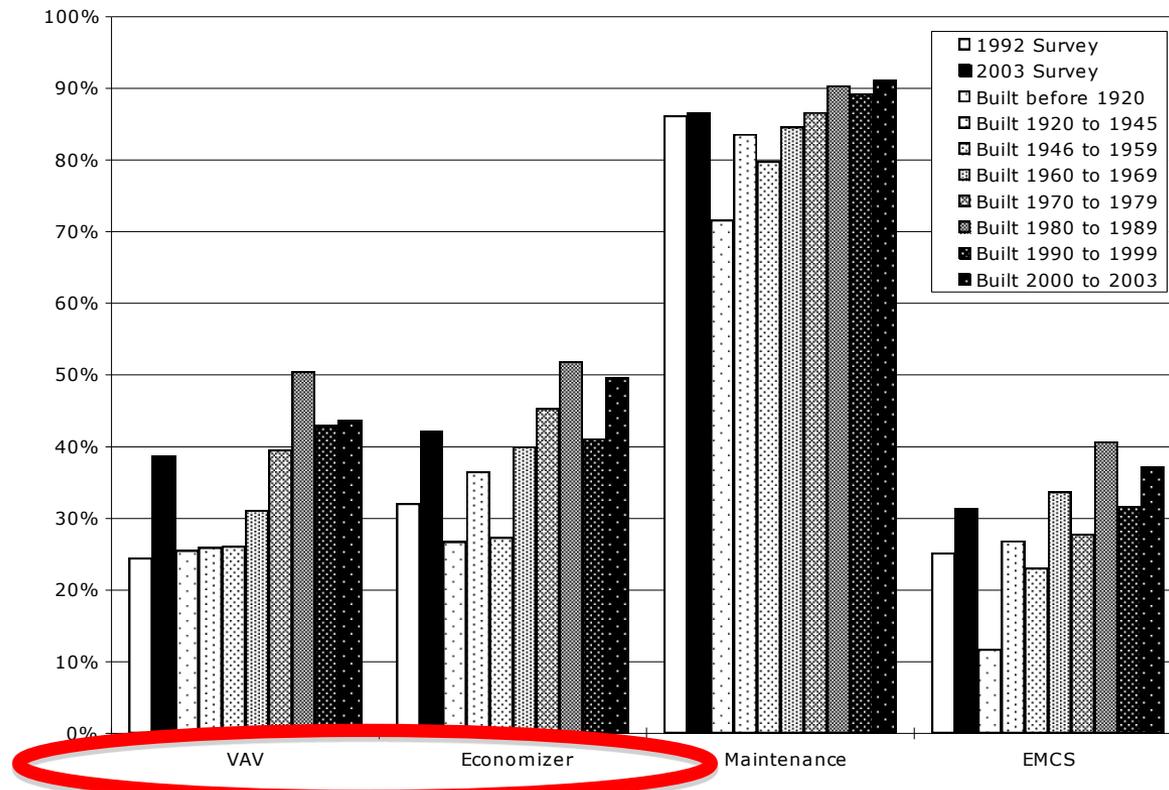
Lighting Technologies in U.S. Commercial Buildings – Innovative Options Less well Diffused



Shown as a percent of total floor area built in that time period.

Since lighting technologies are easy to retrofit, many older buildings have adopted new technologies.

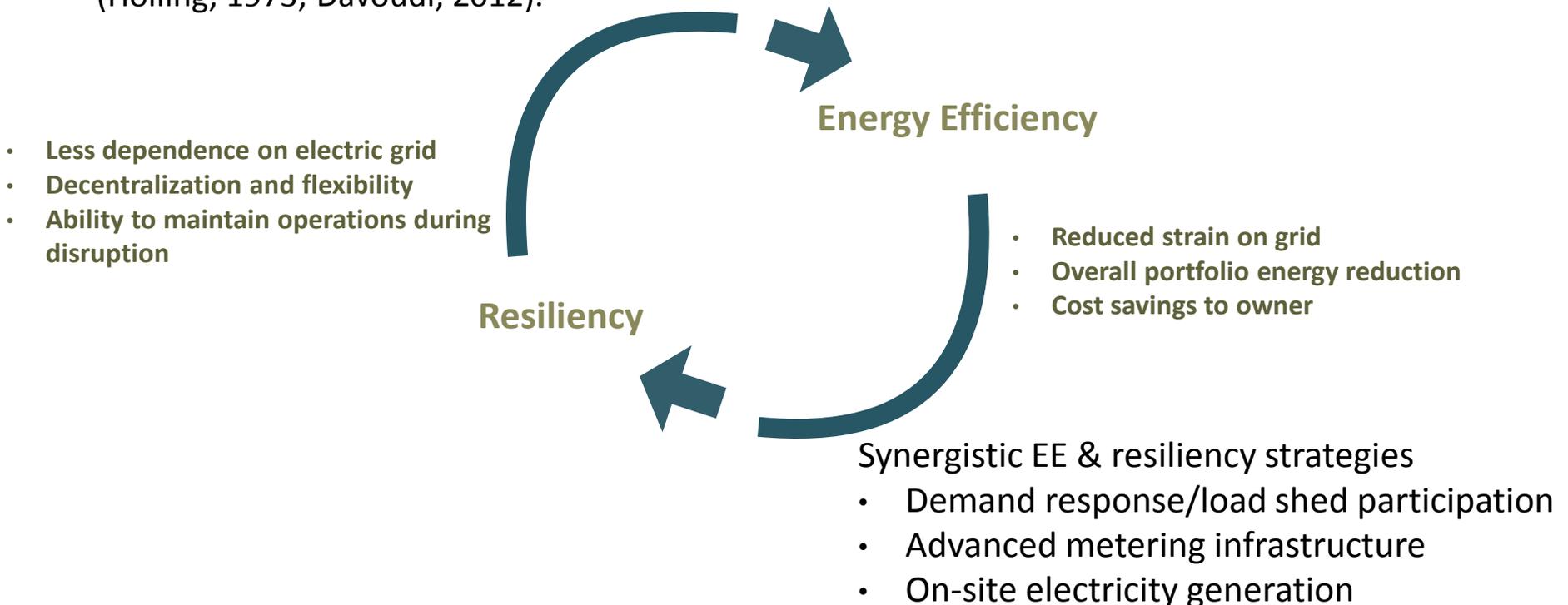
Penetration of HVAC Conservation Technologies in U.S. Commercial Buildings (role of user behavior?)



Penetration is shown as a percent of total cooled floor area built in that time period. Since maintenance is an operating practice, many older buildings have adopted it.

Synergies between energy efficiency and resiliency*

*Engineering: “Ability of a **system** to return to **equilibrium** or a steady-state after a disturbance” (Holling, 1973; Davoudi, 2012).



Metrics & Strategies: International Standards for Energy Management & Resiliency

In addition to seismic, hurricane and tornado oriented building code provisions, the International Standards Organization (ISO) offers many systems for organization-wide adoption of new mgmt practices that are synergistic with energy efficiency objectives:

- ISO 50001: Energy Management
- ISO 31000: Risk Management Principles and Guidelines
- ISO 22301: Societal Security – Business Continuity Management System
- ISO 22323 (under development): Management Systems for Resilience in Organizations
- Building Code Effectiveness Grading Scale(BCEGS®) program
- Design for Risk and Reconstruction Committee of the AIA) and its New York Chapter



IMAGE SOURCE: [HTTP://ECENTER.EE.DOE.GOV/EM/SPM/DOCUMENTS](http://ecenter.ee.doe.gov/em/spm/documents)

