Unlocking Energy Efficiency in the U.S. Economy

ACEEE 30th Anniversary Symposium
Presentation by Ken Ostrowski
April 25, 2010

McKinsey&Company

McKinsey has released two major US energy related research reports in the past three years

U.S. GHG Abatement Cost Curve – December, 2007

- **7 leading institutions joined with McKinsey to co-sponsor**

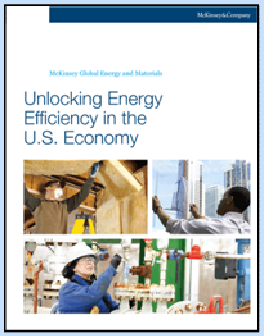
- **Analyzed 250+ abatement opportunities across 7 sectors of the US economy** – buildings, power, transportation, industrial, waste, agriculture and forestry

- Provided comprehensive mapping and fact base of U.S. GHG options
- Highlighted challenge to achieve projected targets
- Published in December 2007

U.S. Energy Efficiency – July, 2009

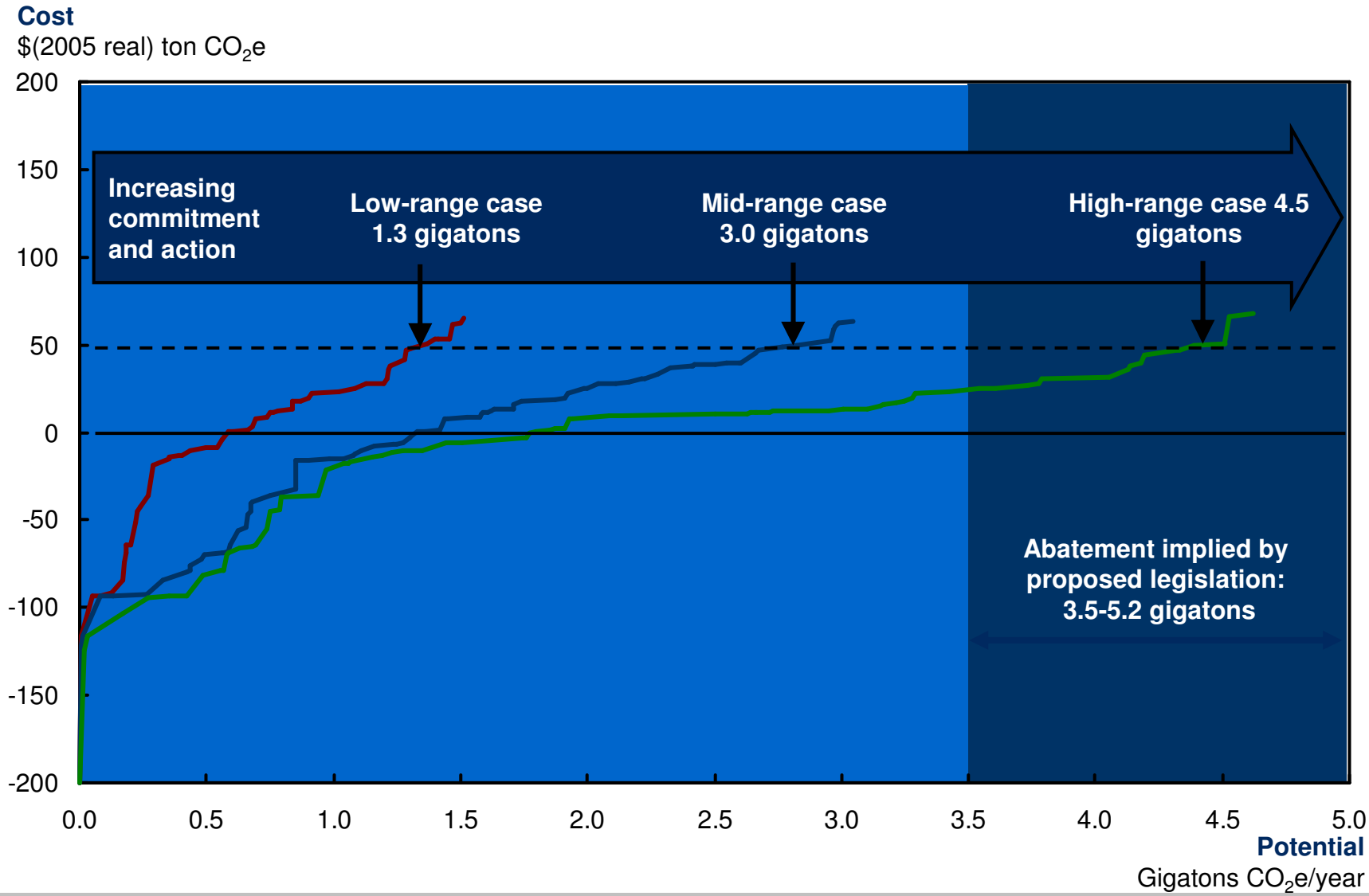
- **12 leading institutions joined with McKinsey to co-sponsor**

- **Analyzed 675+ energy efficiency opportunities in stationary uses economy-wide (with regional breakdown)**



- Provides granularity behind attractive opportunities
- Explores key implementation barriers and potential solutions
- Published in July 2009

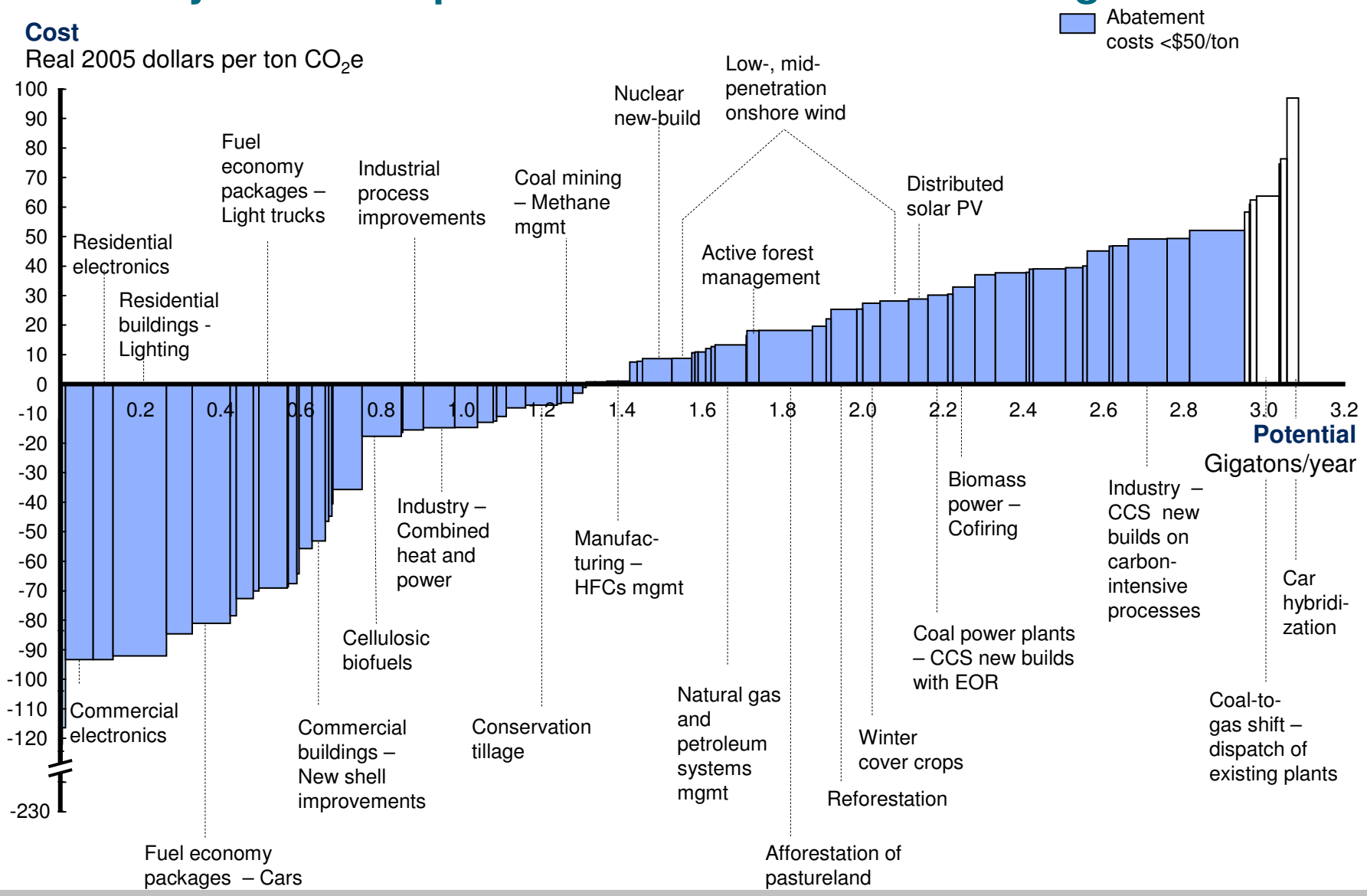
2007 US GHG abatement research identified 3.0 to 4.5 gigatons of reduction potential available with concerted economy-wide action



* Based on bills introduced in Congress that address climate change and/or GHG emissions on an economy-wide basis and have quantifiable targets; targets calculated off the 2030 U.S. GHG emissions of 9.7 gigatons CO2e/year (reference case)

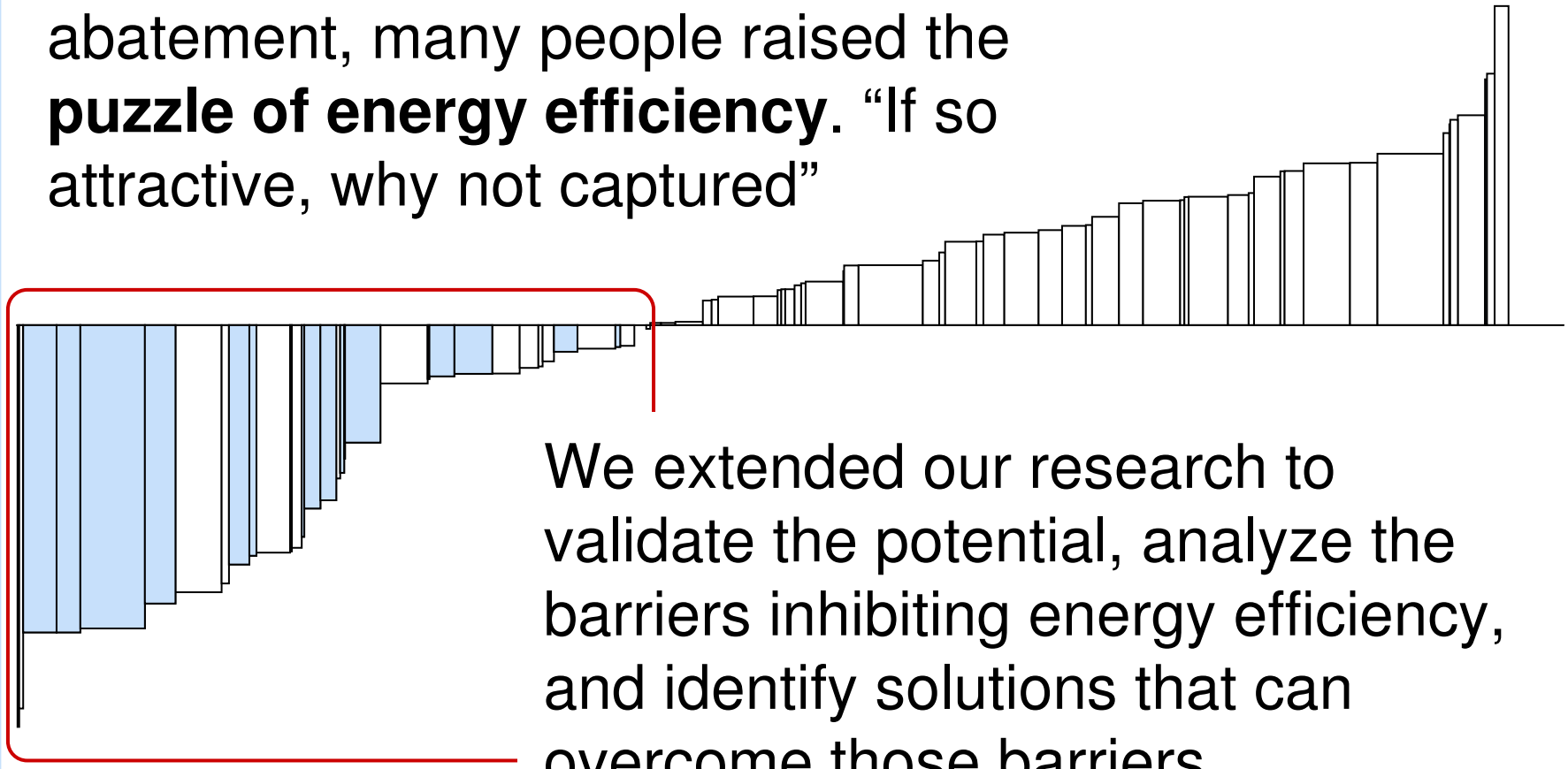
Source: McKinsey analysis

GHG reduction opportunities are widely distributed across efficiency and clean power solutions – 2030 mid-range case



Energy Efficiency Project background

Following our research on U.S. GHG abatement, many people raised the **puzzle of energy efficiency**. “If so attractive, why not captured”



We extended our research to validate the potential, analyze the barriers inhibiting energy efficiency, and identify solutions that can overcome those barriers

We employed a rigorous approach to understand the potential, barriers, and solutions to unlocking energy efficiency in the U.S.

- Analyzed **stationary** uses of energy across residential, commercial, and industrial sectors, including CHP
- Examined over 675 efficient end-use measures, but only **existing technologies**
- Focused on **productivity**; not on conservation (no changes in lifestyle or behavior)
- Analyzed **NPV-positive** applications of energy efficiency; based on incremental capital, operations, and lifetime energy costs – excluded program costs and indirect benefits – discounted at 7 percent
- Identified the **potential** for energy efficiency, the barriers, and potential solutions – *no attempt to declare how much potential will be achieved*

Central Conclusion of our work

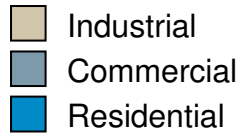
Energy efficiency offers a ***vast, low-cost energy resource*** *for the U.S. economy – but only if the nation can craft a comprehensive and innovative approach to unlock it.*

Significant and persistent barriers will need to be addressed *at multiple levels to stimulate demand for energy efficiency and manage its delivery across more than 100 million buildings and literally billions of devices.*

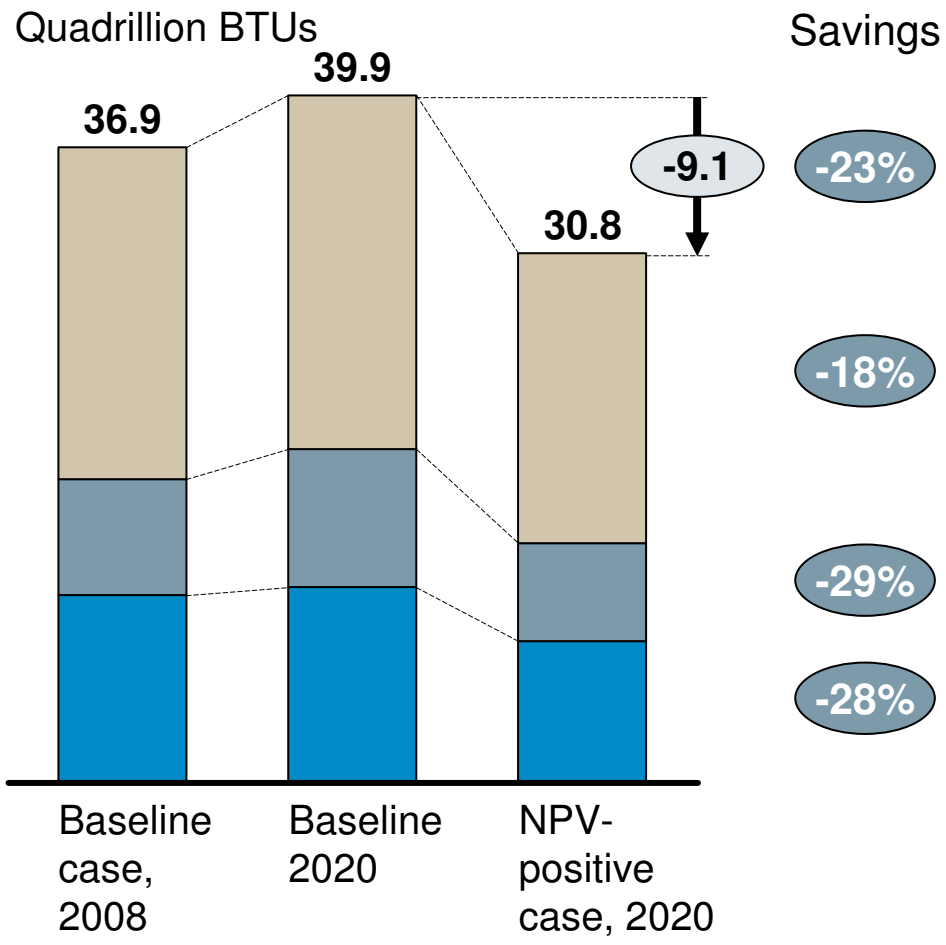
If executed at scale, a holistic approach would yield gross energy ***savings worth more than $1.2 trillion****, well above the* ***$520 billion needed for upfront investment*** *in efficiency measures (not including program costs).*

Such a program is estimated to reduce end-use energy consumption in 2020 by 9.1 quadrillion BTUs, roughly ***23 percent of projected demand****, potentially abating up to* ***1.1 gigatons of greenhouse gases annually.***

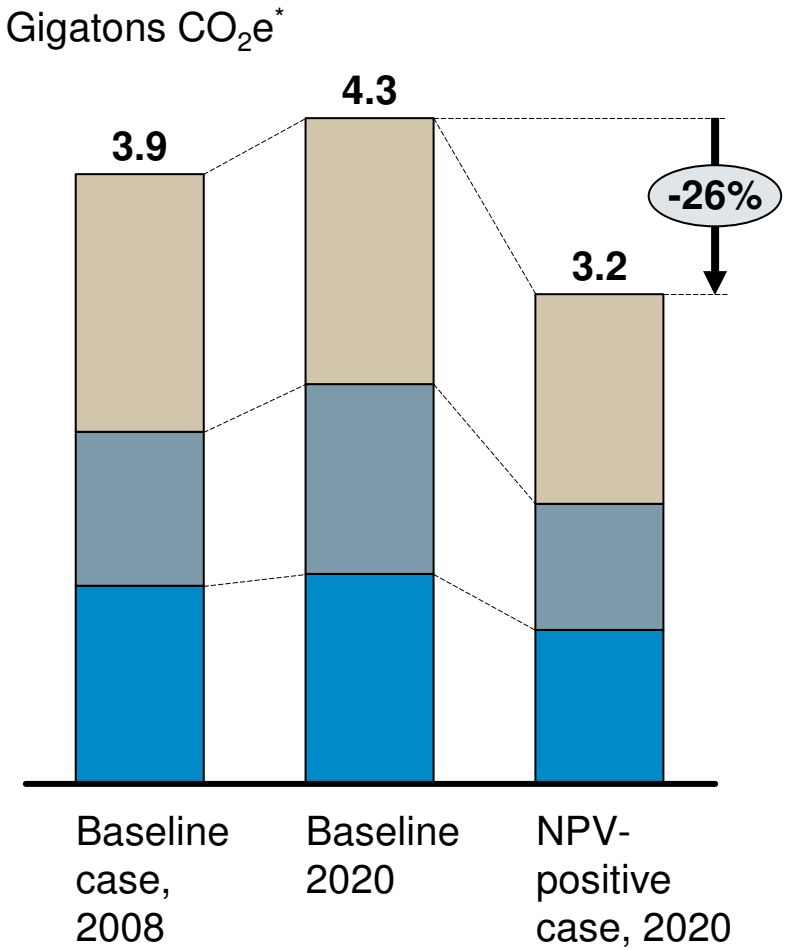
A significant NPV-positive energy efficiency potential exists in the U.S. economy



End-use consumption



Carbon emissions

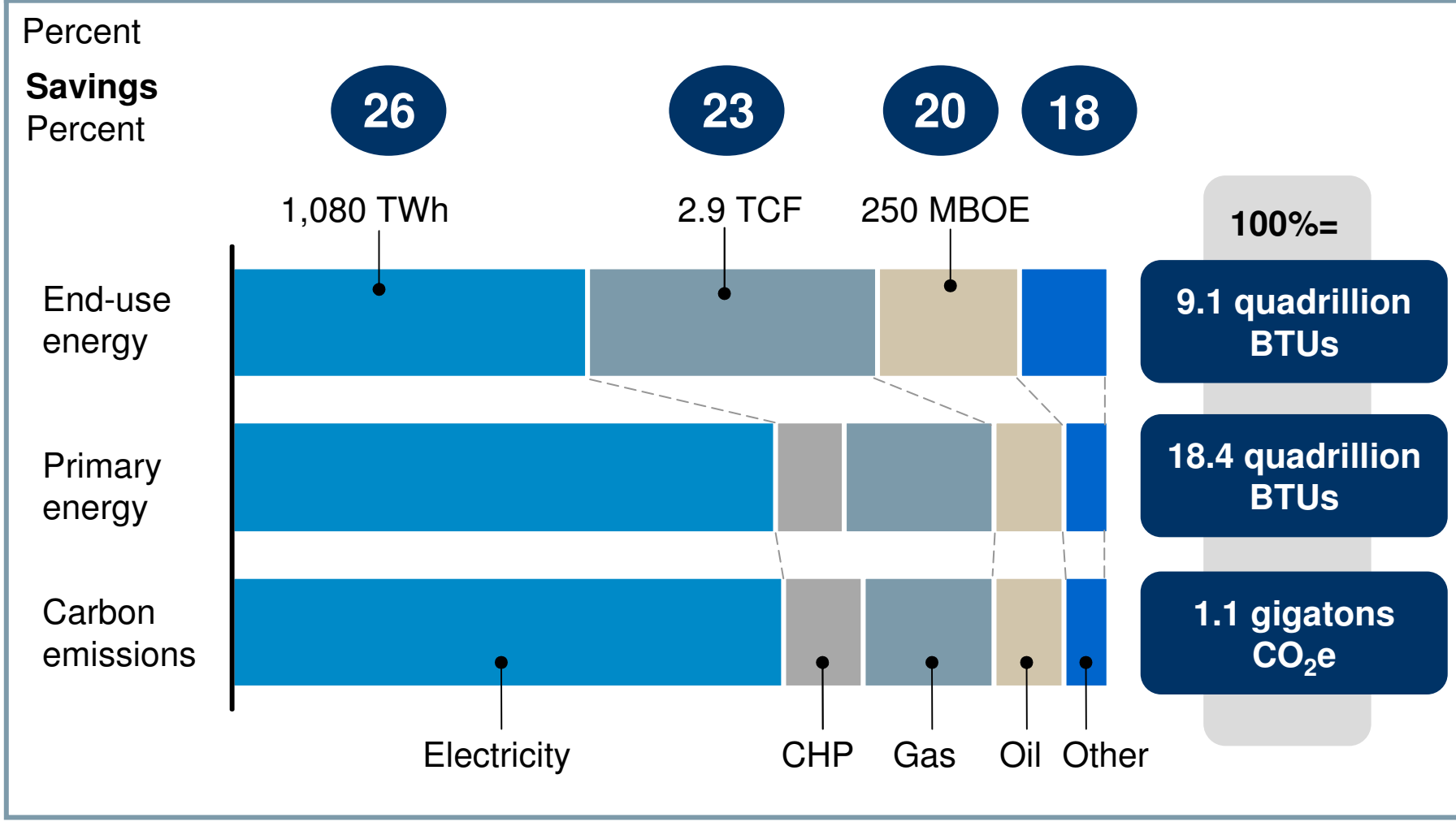


* Includes carbon emission abatement potential from CHP

SOURCE:EIA AEO 2008, McKinsey analysis

The potential is spread across all fuel types and could lead to significant GHG emissions reductions

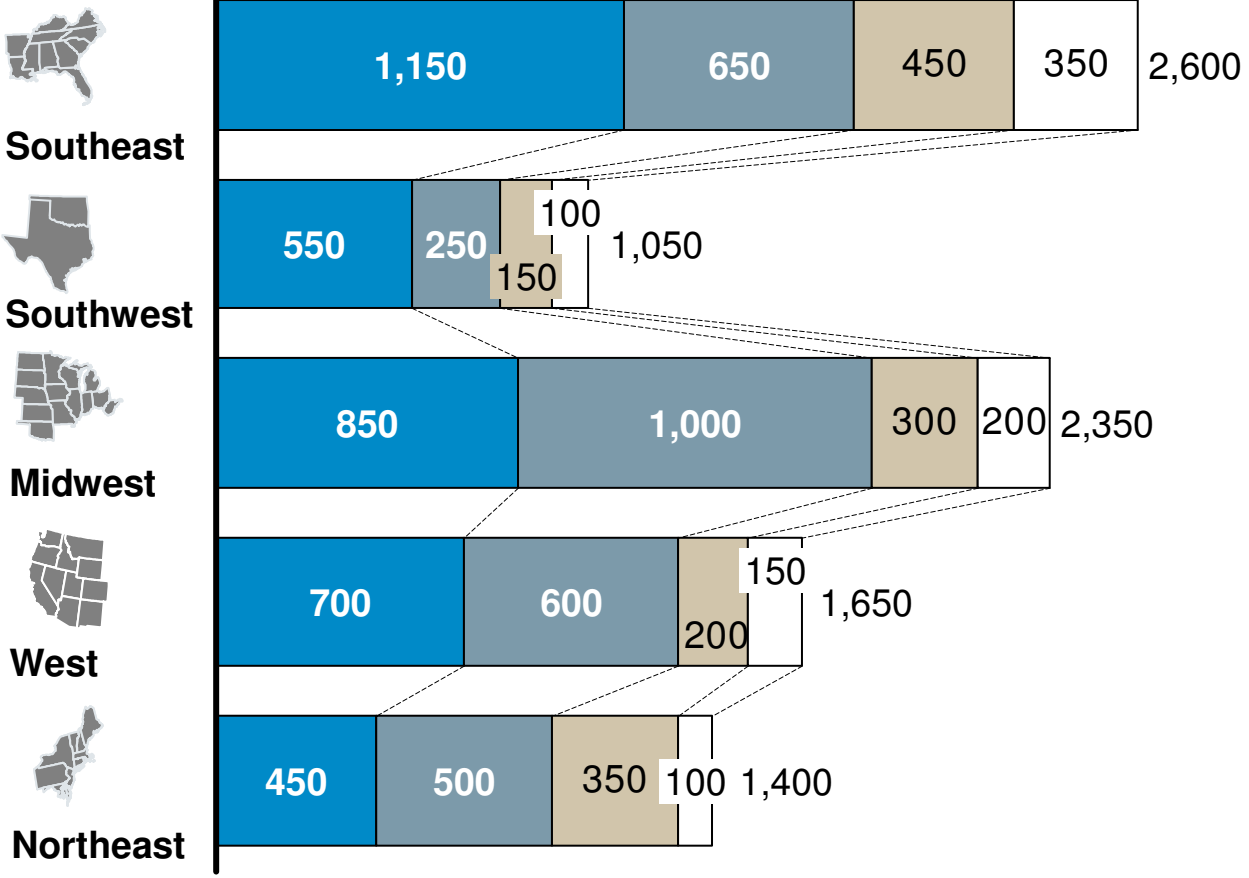
Contribution by energy source to 2020 efficiency potential



SOURCE: EIA AEO 2008, McKinsey analysis

Southeast and Midwest represent over half of the nation's EE potential, though every region has a commensurate reduction potential

Trillion BTUs in 2020*



	Savings (Percent)	
	Reduction from BAU	Share of US Total
Southeast	22	29
Southwest	22	12
Midwest	23	26
West	23	18
Northeast	24	15

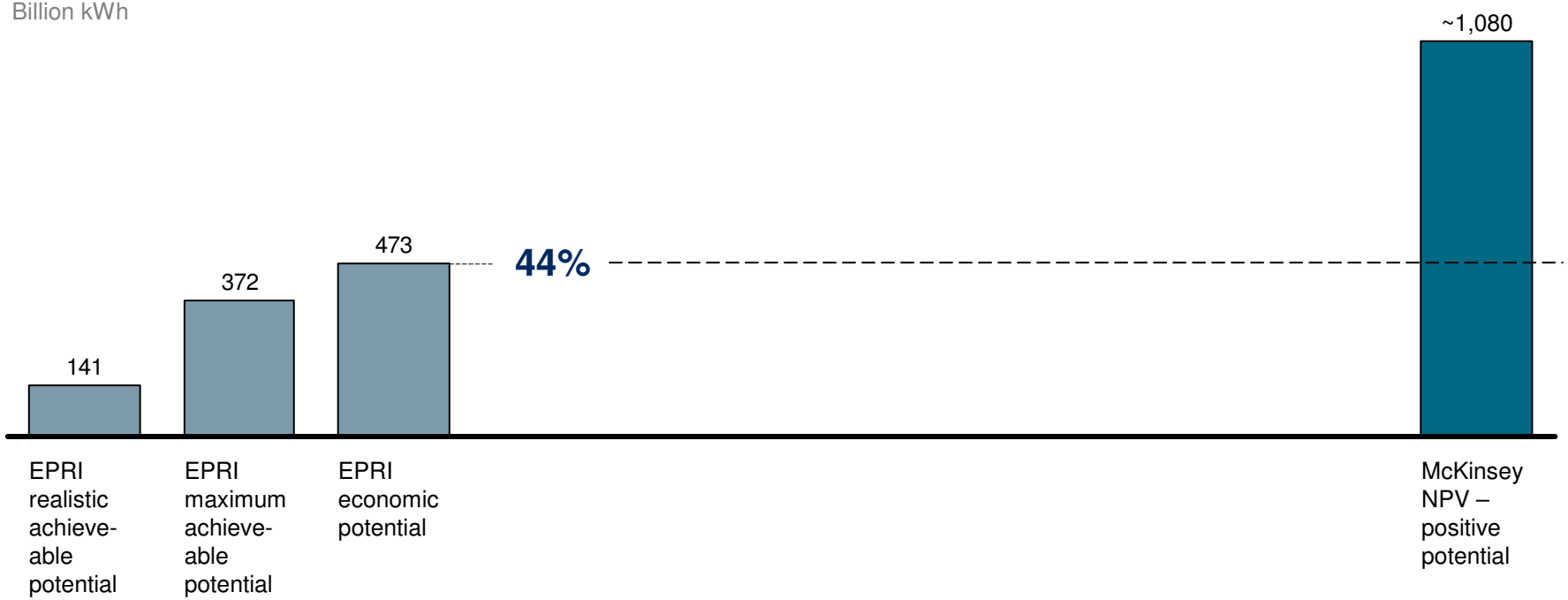
* Numbers rounded to 50 trillion BTUs

Source: EIA AEO 2008, McKinsey analysis

Comparison between EPRI and McKinsey energy efficiency potential values, year 2020

2020 Electricity energy efficiency potential (relative to AEO 2008 reference case)

TWh
Billion kWh



1 Includes small differences in technology performance and cost assumptions, discount rates, and electricity rates between the two reports

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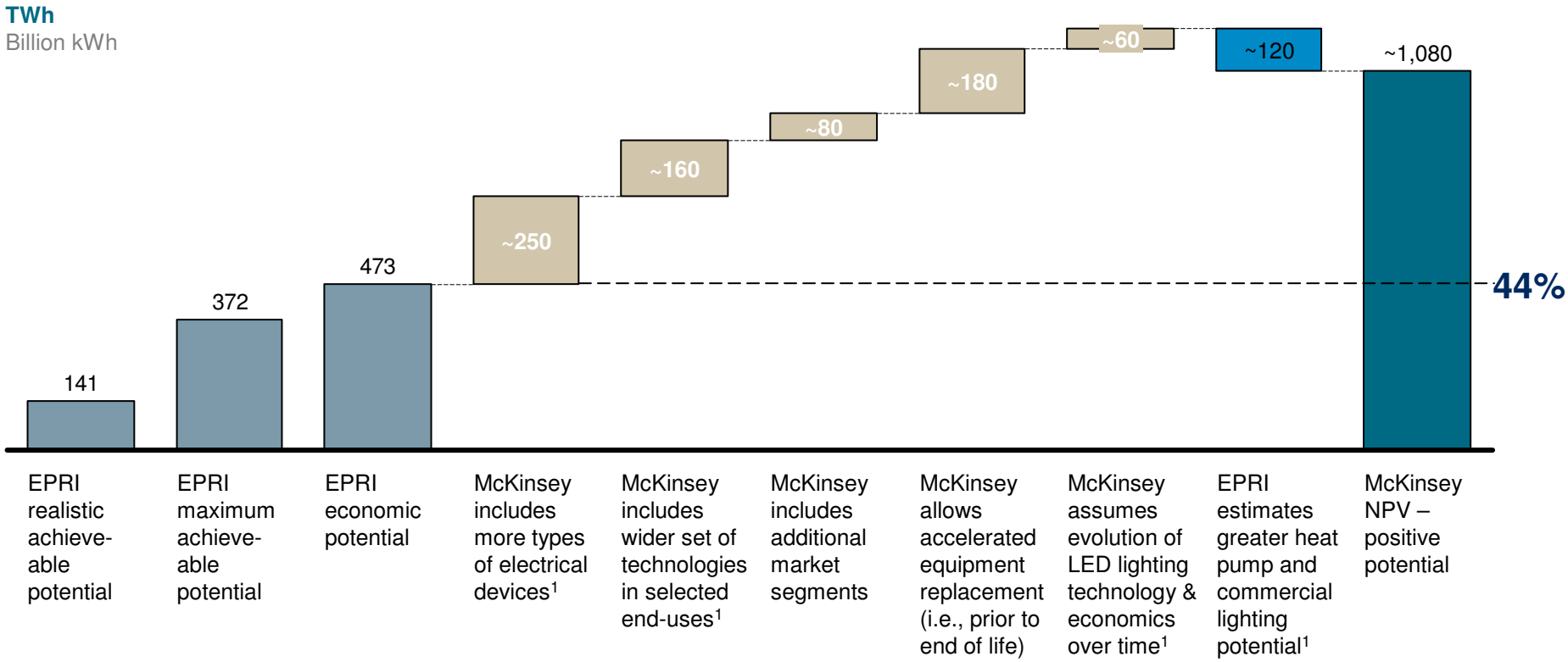

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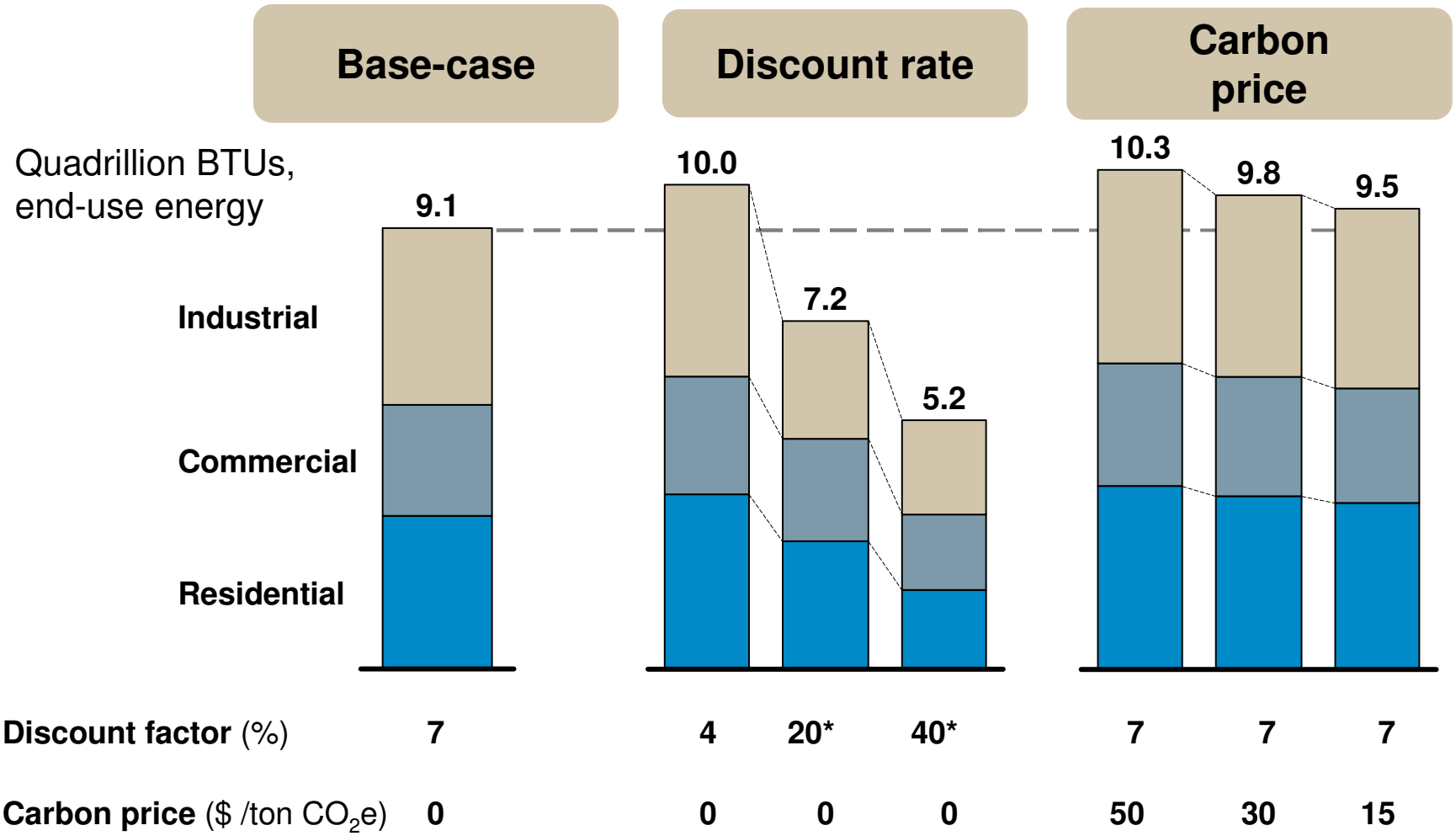
Potential remains attractive even under significant changes in assumptions

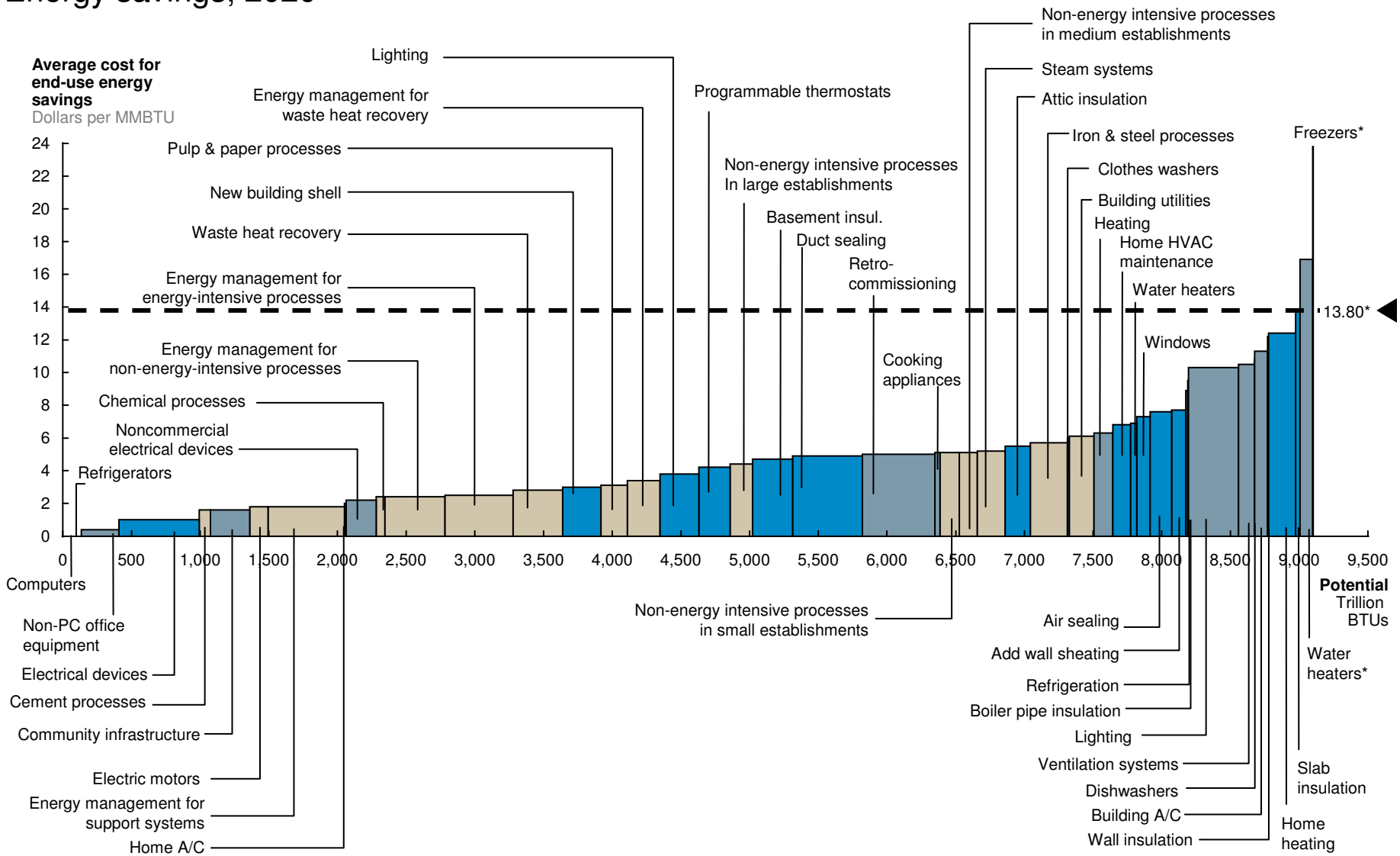


* Utilizes retail rates (vs. lower "avoided cost" rate proxy of industrial rates)

SOURCE: EIA AEO 2008, McKinsey analysis

Energy efficiency offers the most affordable means of delivering energy: all sources expressed in end-use BTUs

Energy savings, 2020



SOURCE: EIA AEO 2008, McKinsey analysis

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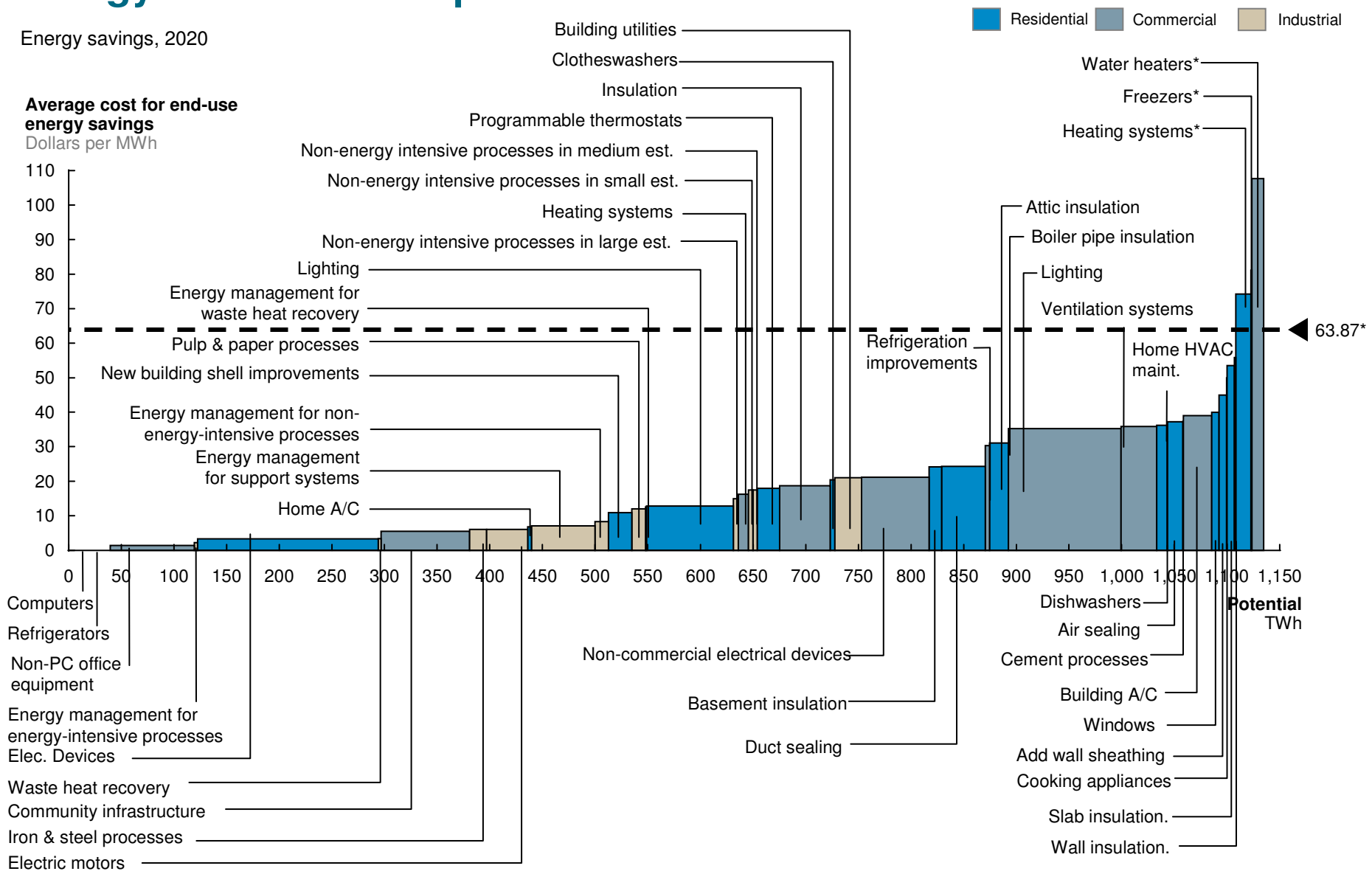


* Average price of avoided electricity consumption at the industrial price; $121.47/MWh represents the highest regional price

SOURCE: EIA 2008; NEMS 2008; McKinsey analysis

The fundamental nature of energy efficiency creates challenges

FUNDAMENTAL ATTRIBUTES OF ENERGY EFFICIENCY

Requires outlay	Full capture would require upfront outlay of about $50 billion per year, plus program costs
Fragmented	Potential is spread across more than 100 million locations and billions of devices
Low mind-share	Improving efficiency is rarely the primary focus of any in the economy
Difficult to measure	Evaluating, measuring and verifying savings, is more difficult than measuring consumption

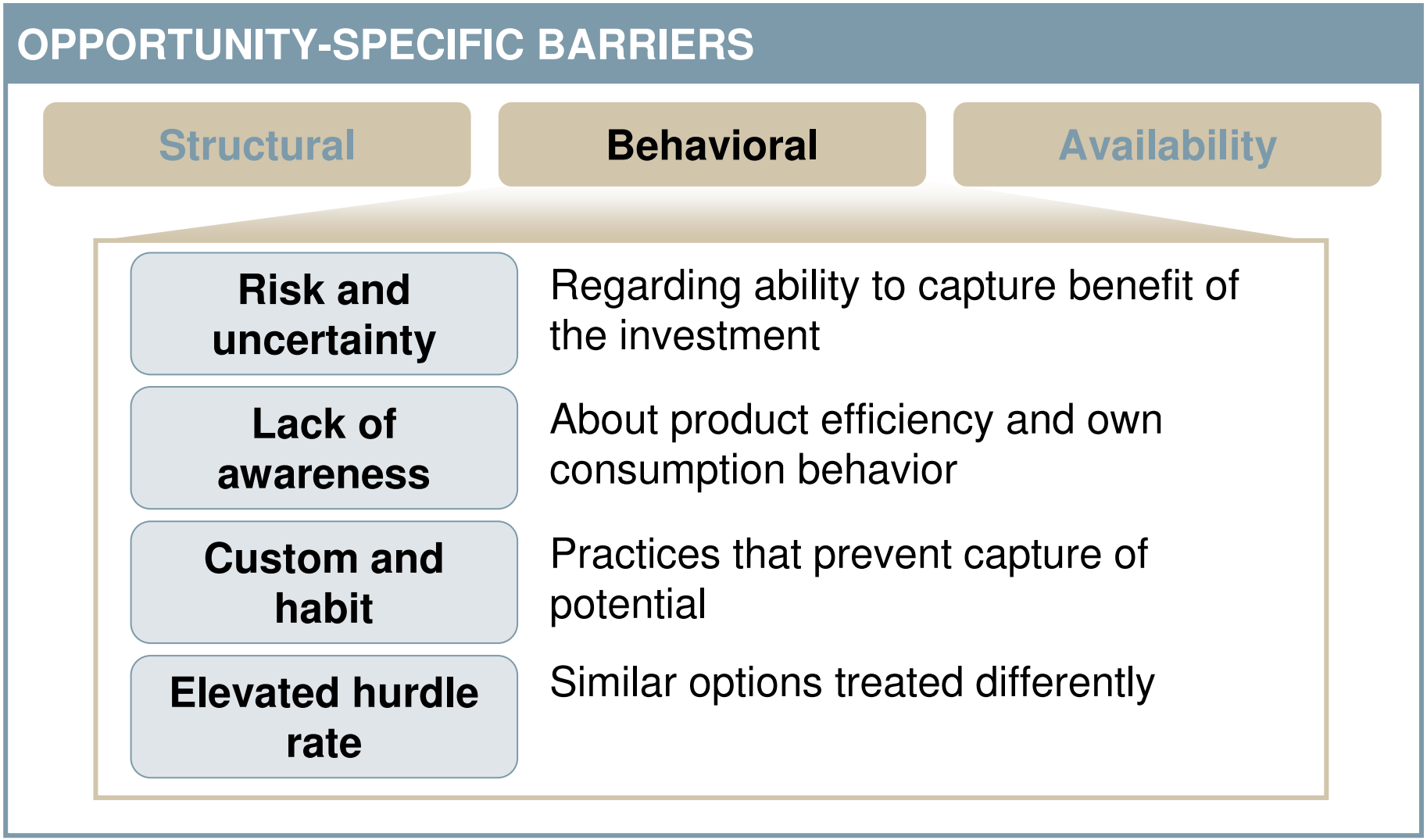
Additional opportunity-specific barriers inhibit energy efficiency (1/3)

OPPORTUNITY-SPECIFIC BARRIERS

Structural | Behavioral | Availability

Agency	Incentives split between parties, impeding capture of potential
Ownership transfer issue	Owner expects to leave before payback time
Transaction barriers	Unquantifiable incidental costs of deployment
Pricing distortions	Regulatory, tax, or other distortions

Additional opportunity-specific barriers inhibit energy efficiency (2/3)



Additional opportunity-specific barriers inhibit energy efficiency (3/3)

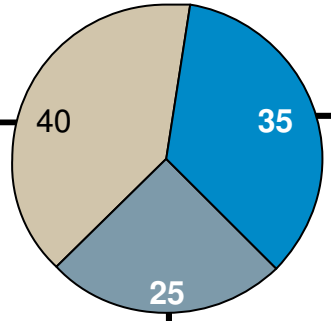
OPPORTUNITY-SPECIFIC BARRIERS

Structural | Behavioral | **Availability**

Adverse bundling	Combining efficiency savings with costly options
Capital constraints	Inability to finance initial outlay
Product availability	Insufficient supply or channels to market
Installation and use	Improperly installed and/or operated

Opportunities group into actionable clusters based on barriers

Percent, 100% = 9,100 trillion BTUs of end-use energy efficiency potential



Industrial

Total (Trillion BTUs)

3,650

- Non-energy intensive Industry processes: 24
- Energy-intensive industry processes: 43
- Energy support systems: 33

N = 330,000 enterprises

CHP is an additional cluster with potential of 1.4 qBTUs of primary energy

Commercial

Total (Trillion BTUs)

2,290

- Community infrastructure: 12
- Office and non-commercial equipment: 13
- New private buildings: 16
- Government buildings: 25
- Existing private buildings: 35

N = 4.9 million buildings, ~3 billion devices

Residential

Total (Trillion BTUs)

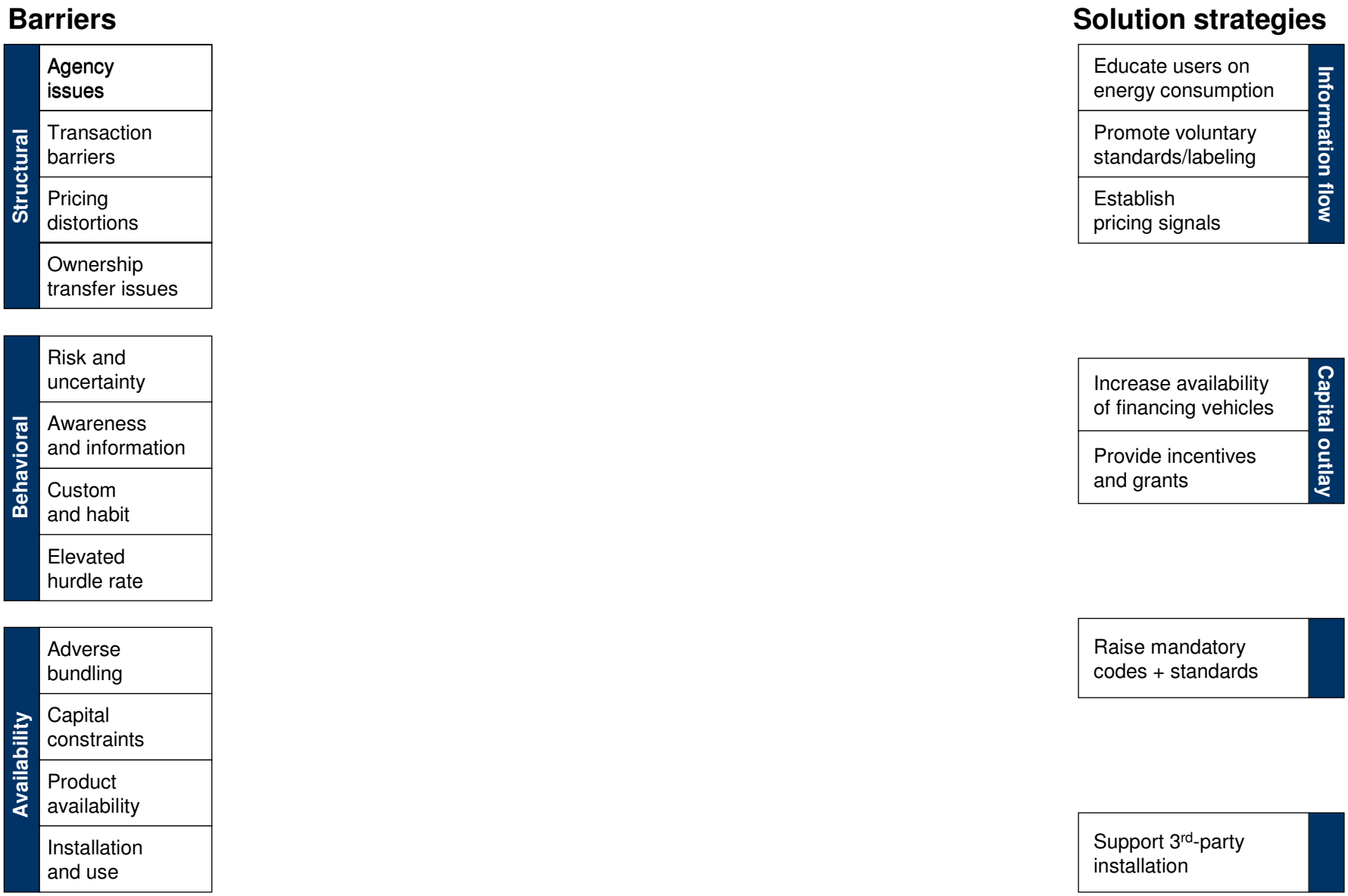
3,160

- Lighting & major appliances: 11
- Electrical devices & small appliances: 19
- New homes: 10
- Existing low-income homes: 19
- Existing non-low income homes: 41

N = 129 million homes, 2.5 billion devices

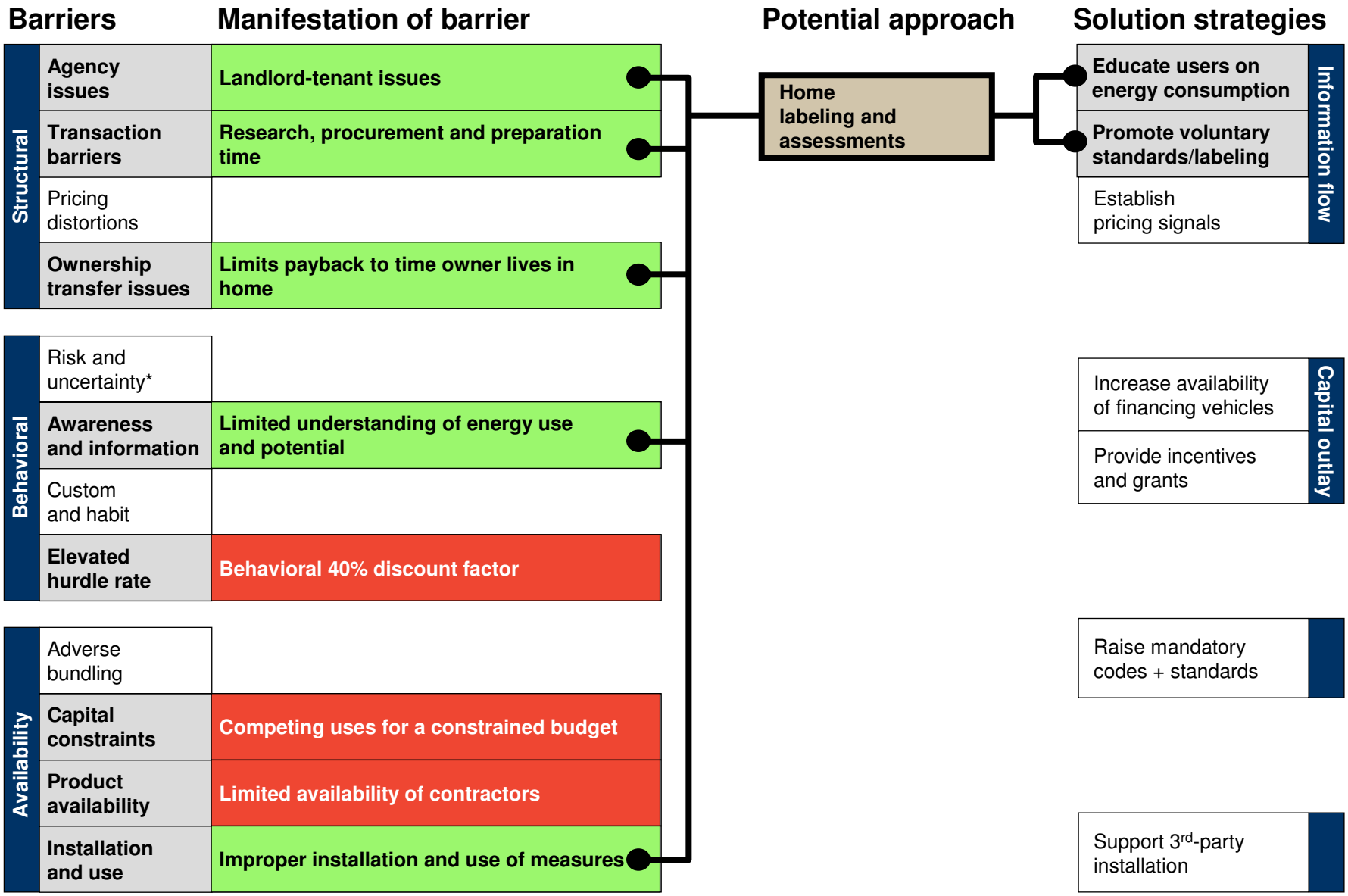
SOURCE: Energy Information Agency's Annual Energy Outlook 2008; McKinsey analysis

In addition to barriers, we identified a set of solution strategies. The challenge is mapping solutions against barriers to achieve success



Source: McKinsey analysis

Example: Addressing barriers in non-low income homes



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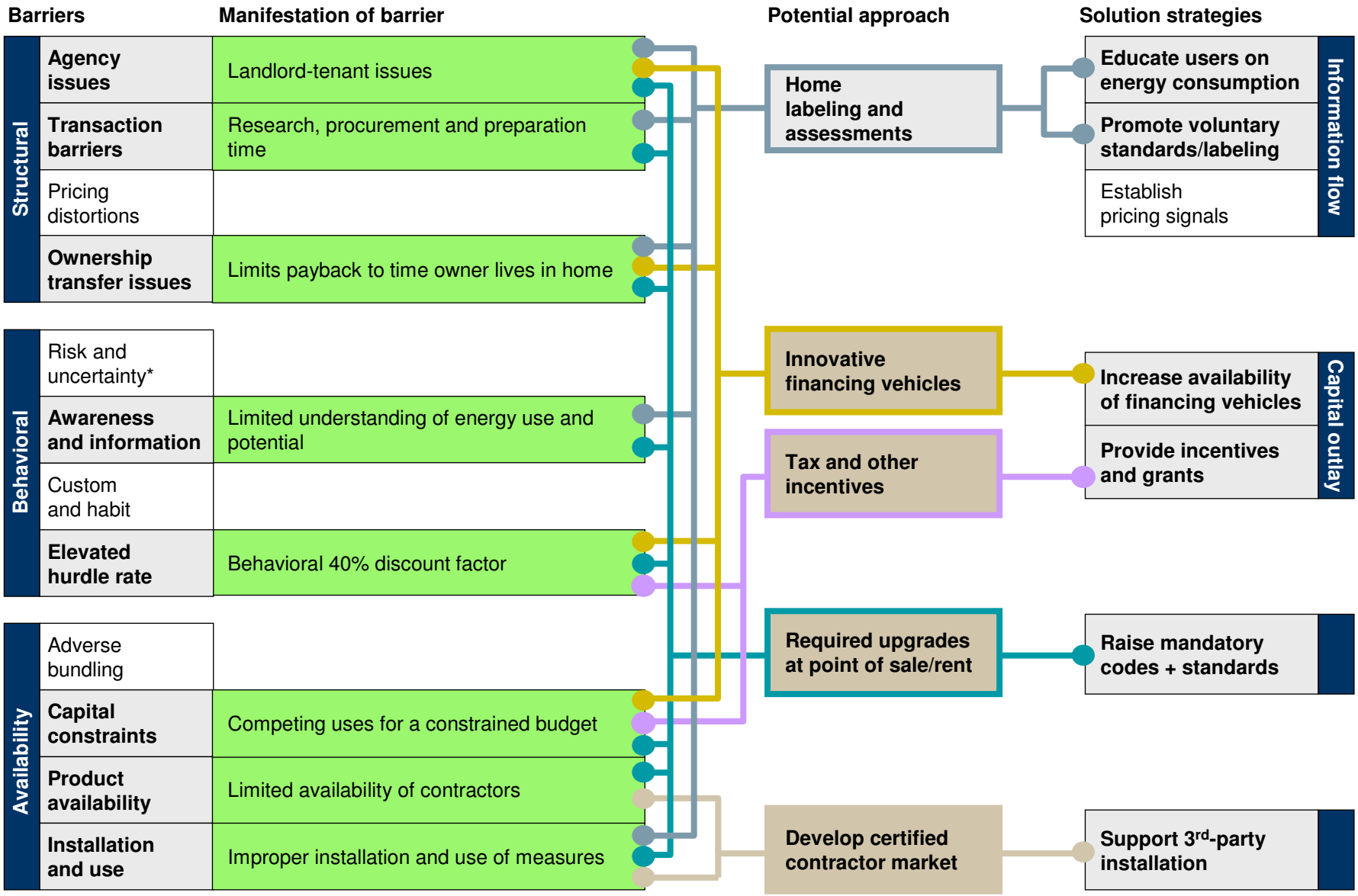
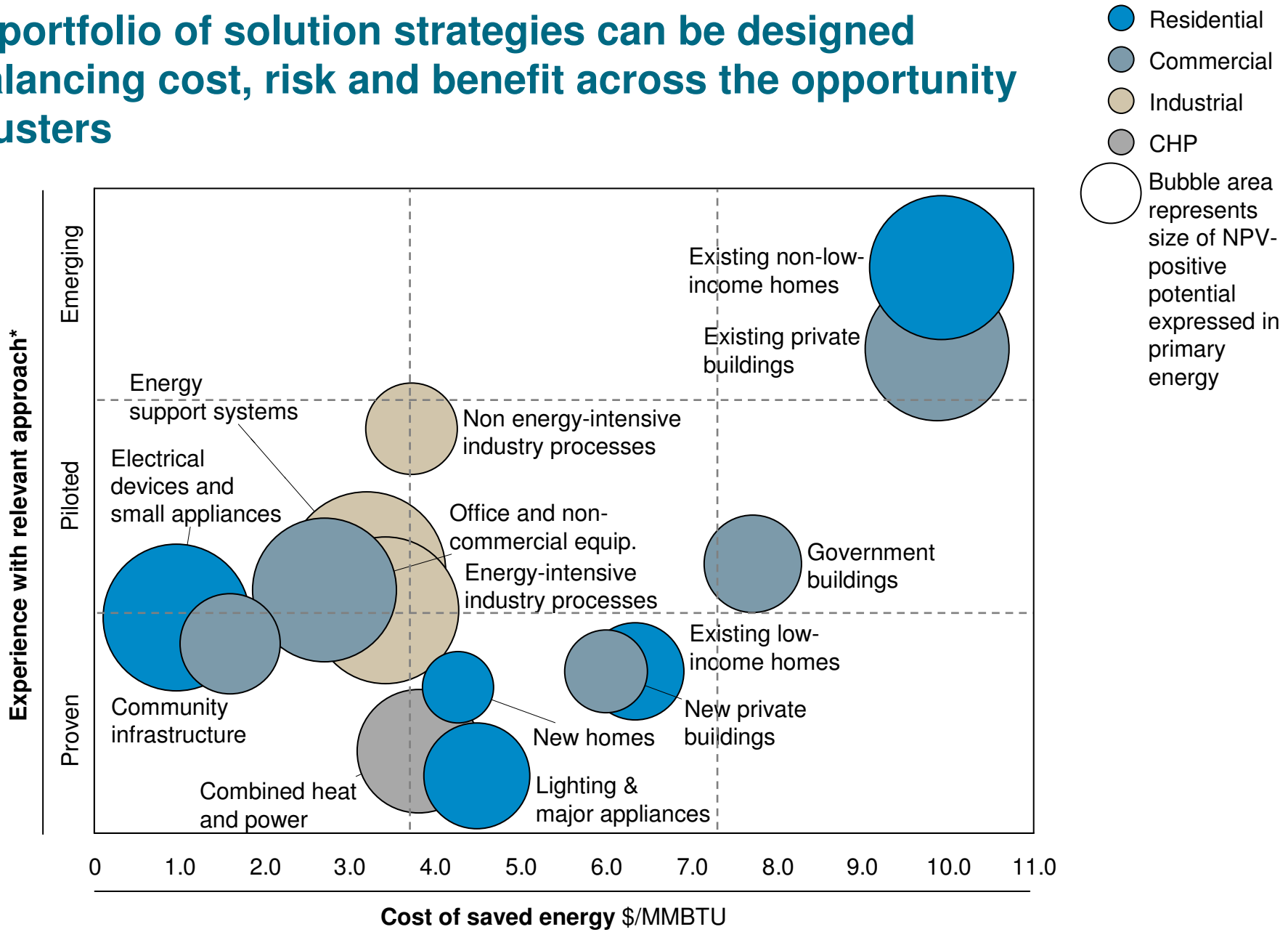
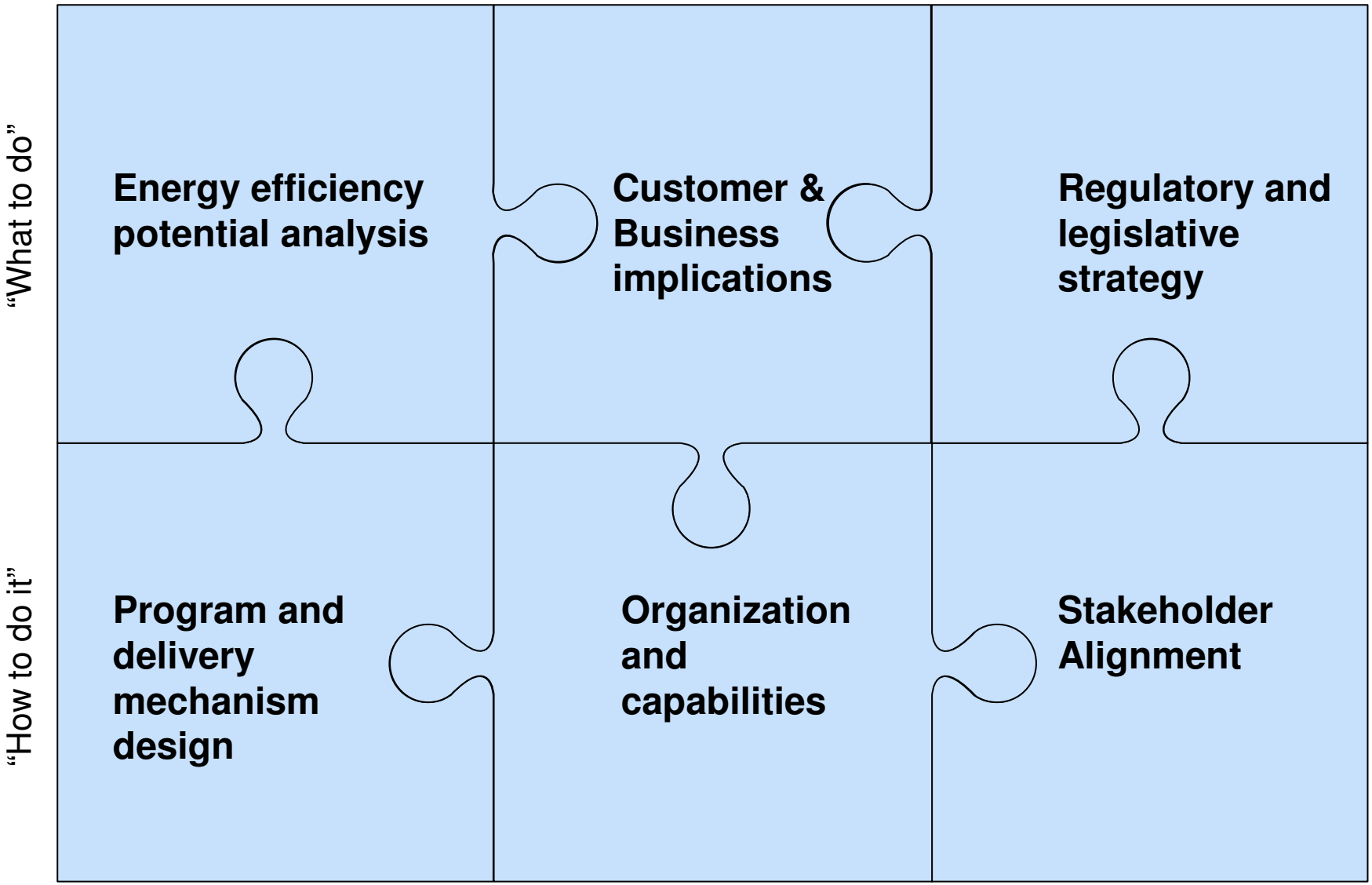


Source: McKinsey analysis

A portfolio of solution strategies can be designed balancing cost, risk and benefit across the opportunity clusters



Building blocks of a comprehensive energy efficiency strategy



Summary observations

- **Recognize energy efficiency as an important energy resource** while the nation concurrently develops new energy sources
- **Launch an integrated portfolio** of proven, piloted, and emerging approaches
- Identify methods to **provide upfront funding**
- **Forge greater alignment** among stakeholders
- **Foster development** of next-generation energy efficient technologies