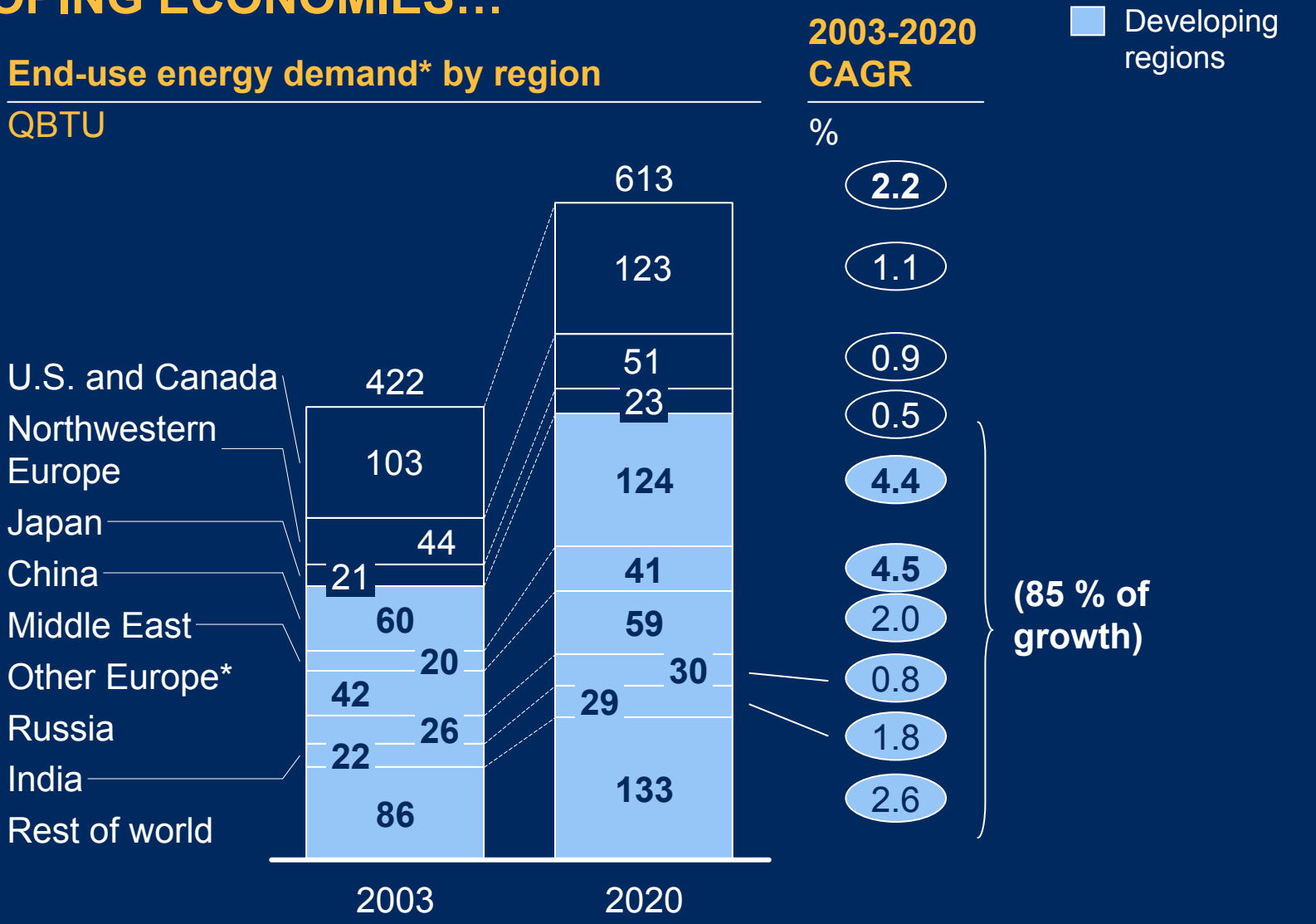
McKinsey Global Institute

CONFIDENTIAL

Energy Productivity: A Foundation for Competitiveness, Security, and Sustainability

Discussion with Council on Competitiveness—Energy Security, Innovation, and Sustainability Initiative
September 14, 2007

MOST DEMAND GROWTH COMES FROM DEVELOPING ECONOMIES…



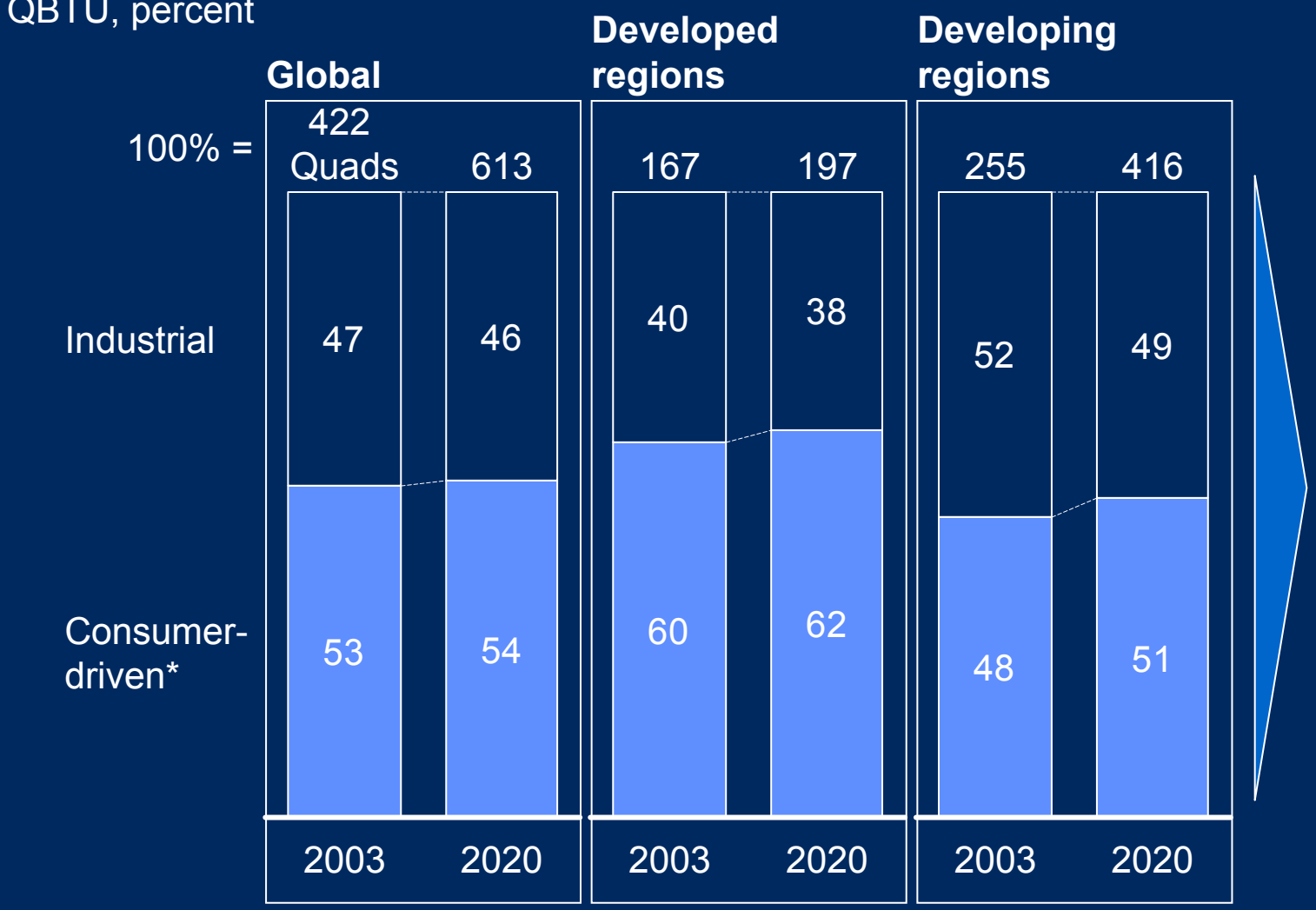
* Transformation losses (power generation. refining) allocated to end-use segments.

** Includes Baltic / Eastern and Mediterranean Europe and North Africa

Source: MGI Global Energy Demand Model

… AND IS CONSUMER-DRIVEN

End-use energy demand 2003-2020 by region
QBTU, percent



- The share of global demand driven by consumers increases from 53% to 54%
- Consumers drive 57% of global demand growth (70% in developed regions, 55% in developing regions)

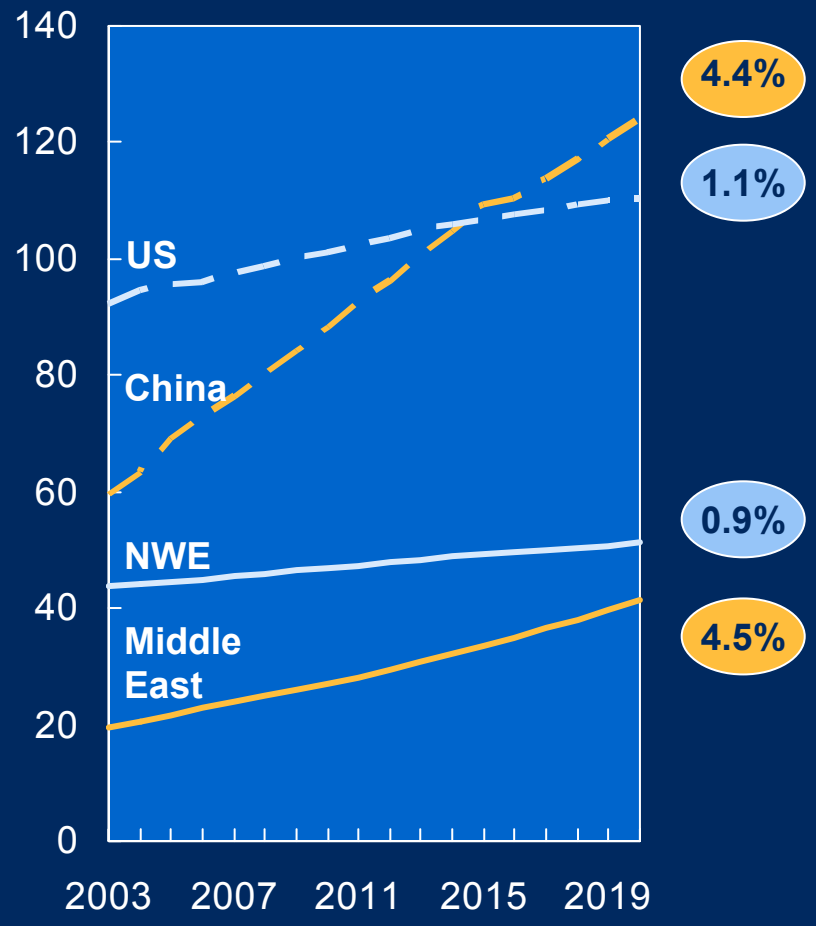
* Air and road transportation; residential and commercial buildings

Source: MGI Global Energy Demand Model

ENERGY DEMAND IN CHINA AND THE MIDDLE EAST CATCHES UP WITH THE US AND NORTHWESTERN EUROPE BY 2020

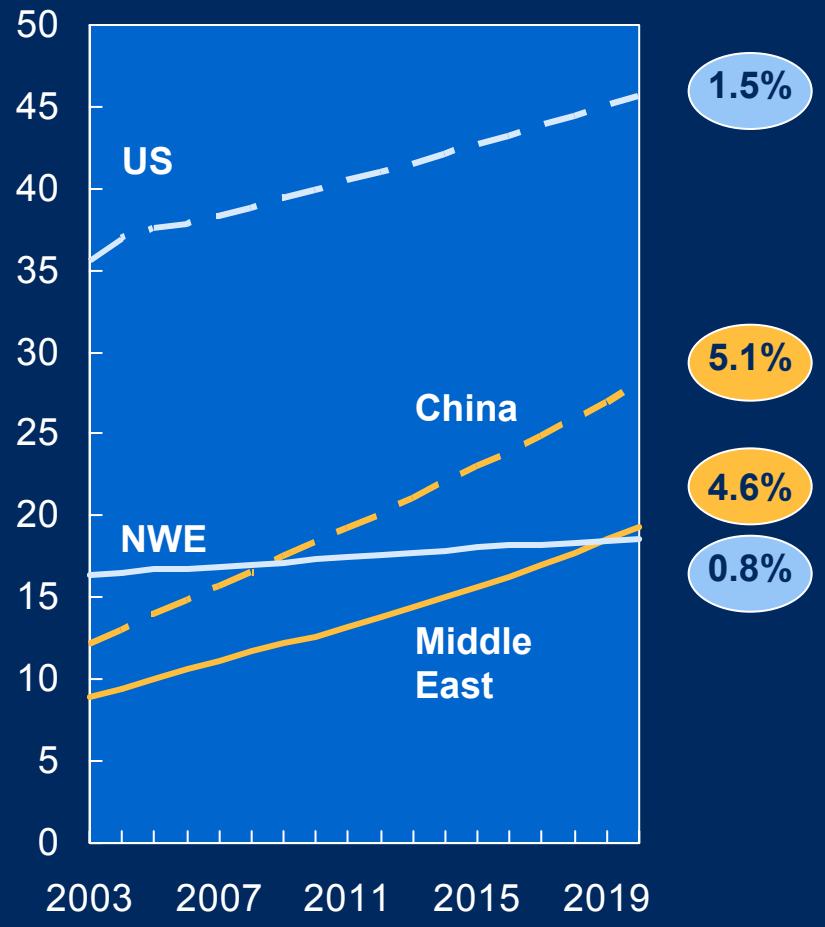
Total primary energy demand
QBTU

2003-20
CAGR



Total petroleum product demand
QBTU

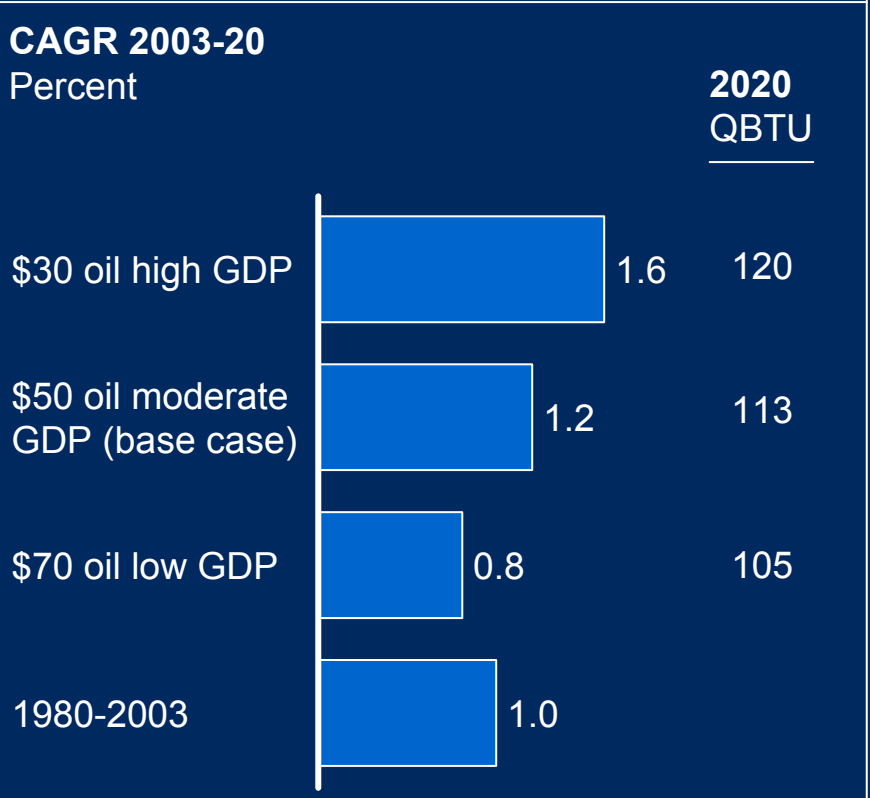
2003-20
CAGR



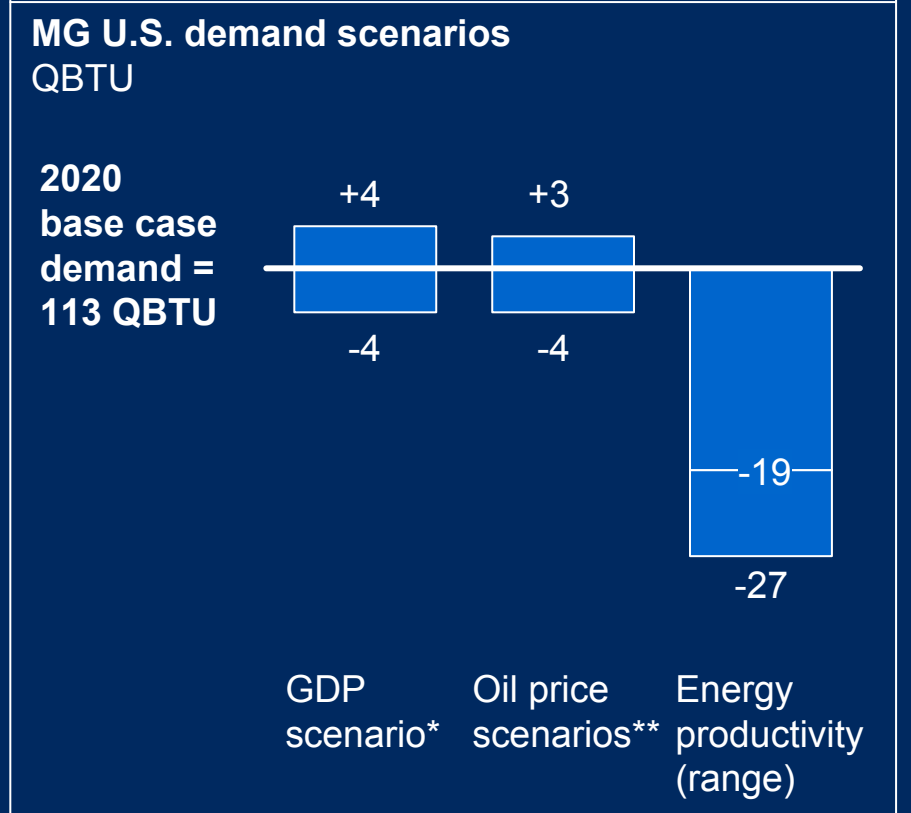
Source: MGI Global Energy Demand Model

U.S. ENERGY DEMAND GROWTH ACCELERATES TO 1.2%; ENERGY PRODUCTIVITY THE LARGEST UNCERTAINTY

Energy demand growth 2003-20 outpaces historical period in most scenarios



Energy productivity is the main uncertainty for energy while oil price and GDP have a more moderate, similar impact

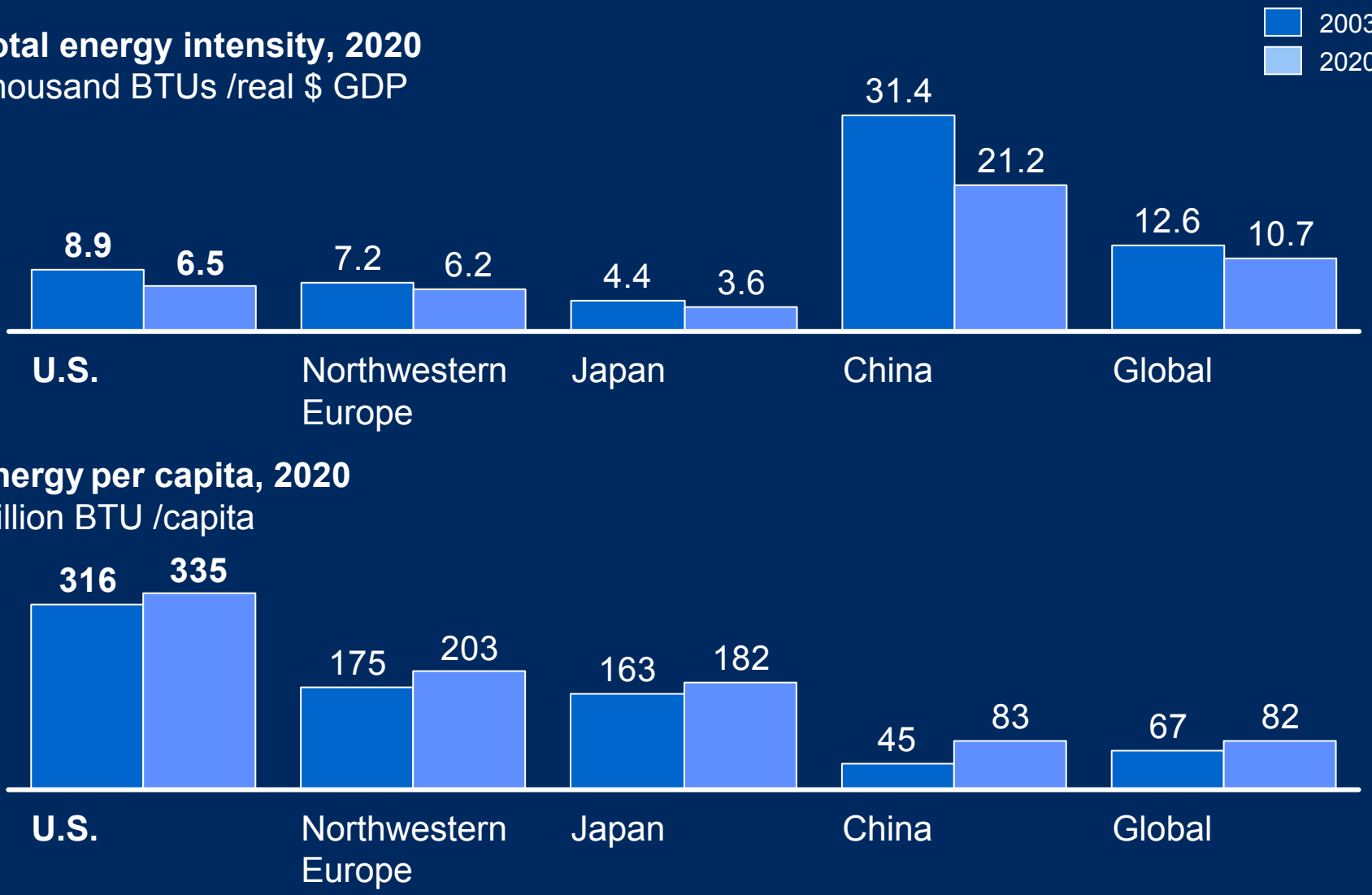


* ± 0.5% vs. Global Insight GDP growth projection
** 30$ and 70$ oil scenarios vs. base case of 50$ oil scenario

Source: EIA; McKinsey Global Institute

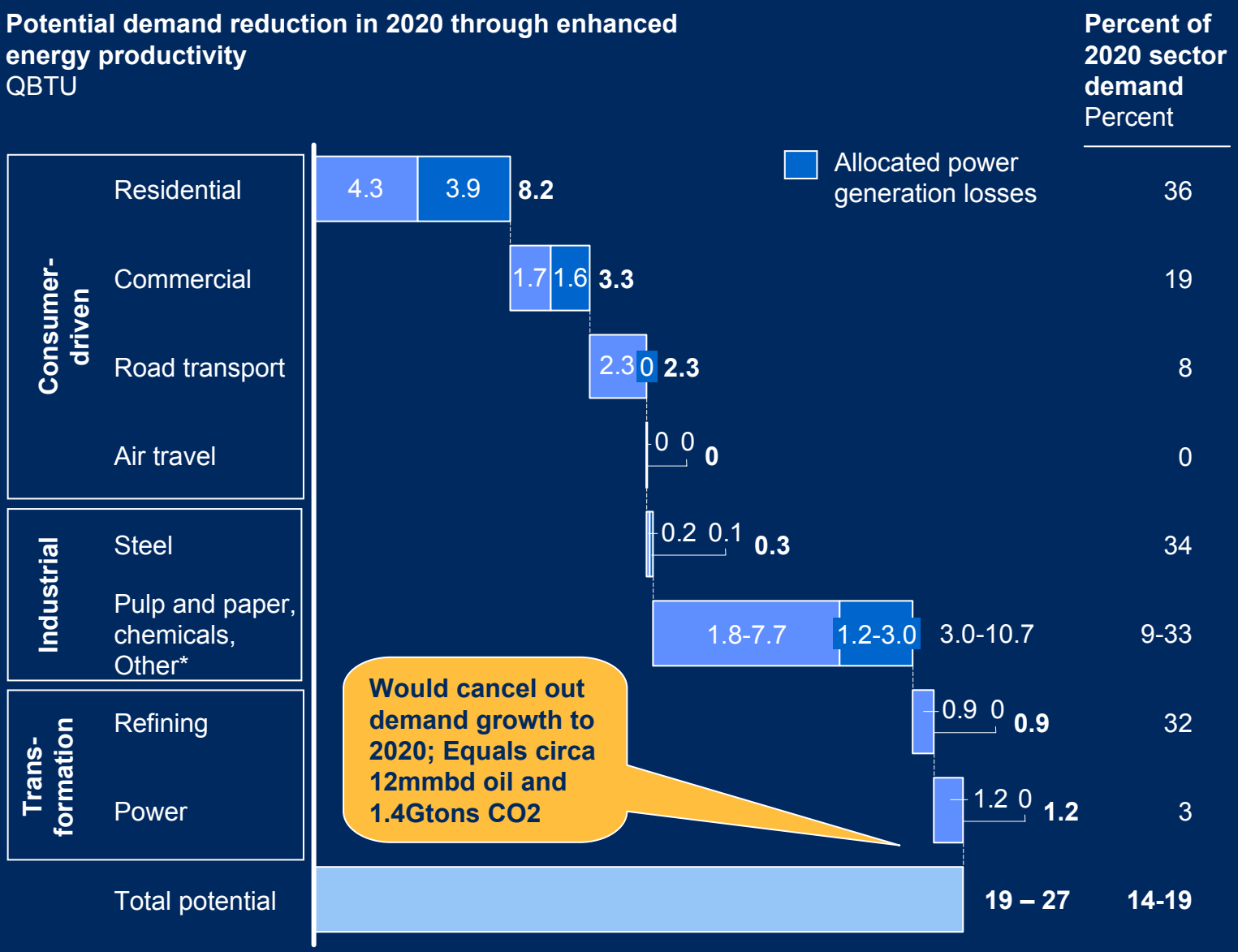
THE U.S. REMAINS THE MOST ENERGY INTENSIVE DEVELOPED REGION

$50 OIL SCENARIO
BASE CASE GDP



Source: Global energy demand model v75; McKinsey Global Institute

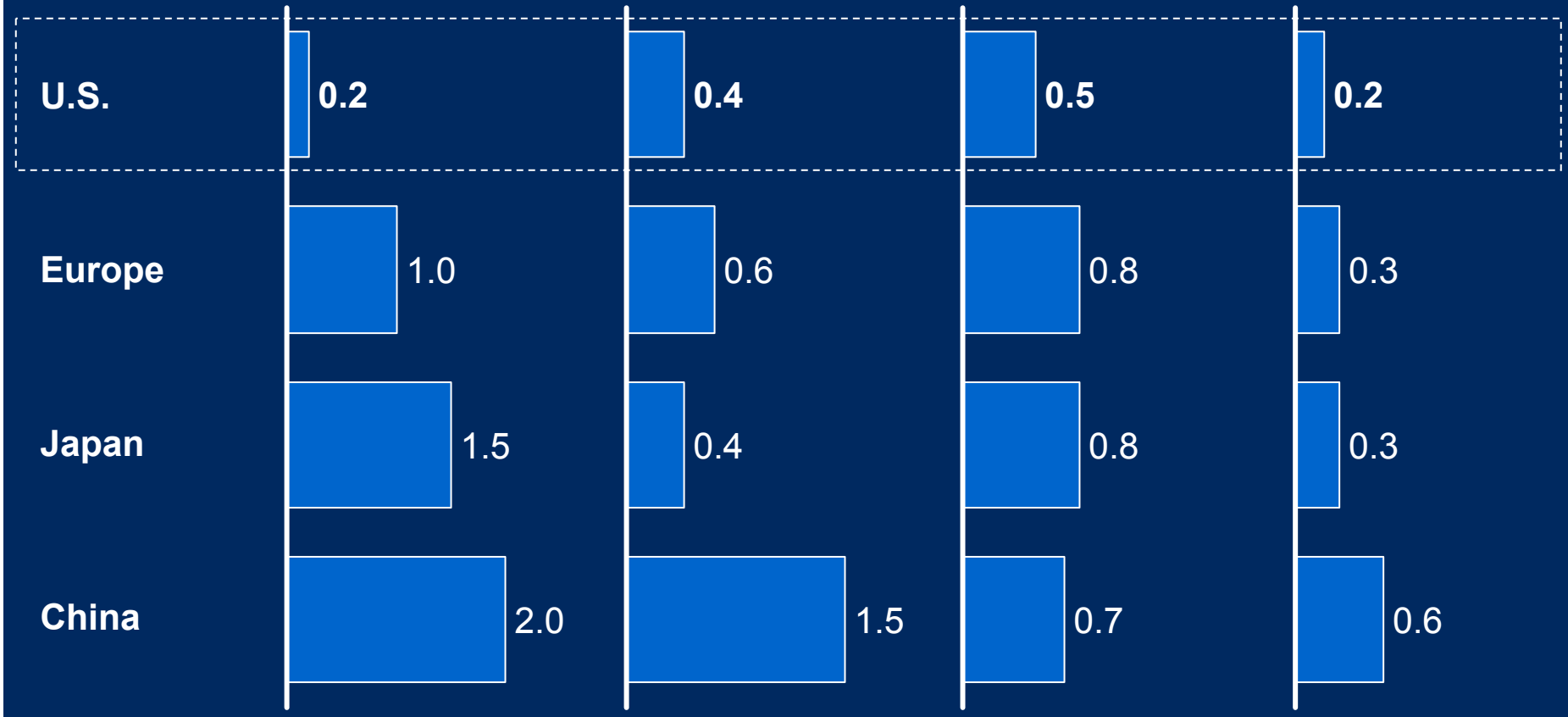
US ENERGY PRODUCTIVITY OPPORTUNITY



Source: McKinsey Global Institute

ENERGY PRODUCTIVITY IMPROVEMENTS ARE LOWER IN THE U.S. THAN IN EUROPE AND JAPAN ACROSS ALL SECTORS

Annual improvement of energy-productivity indicators, 2003-2020



Source: EIA, Lawrence Berkeley National Lab China Energy Group, McKinsey Global Institute

LIKE LABOR AND CAPITAL PRODUCTIVITY, ENERGY PRODUCTIVITY IS RELEVANT FOR COMPETITIVENESS

- Energy productivity measures the output and quality of goods and services generated with a given set of inputs
  - $79 billion of GDP per QBTU of energy inputs globally
  - The inverse--energy intensity of GDP equals 12,600 BTUs/GDP $ output.
- Energy productivity improvements can be achieved either by reducing the energy inputs required to produce the same level of energy services, or by increasing the quantity or quality of economic output
- When identifying opportunities for energy productivity improvements, we focus on changes that rely on currently existing technologies and have an internal rate of return (IRR) of 10 percent or more
- Our exclusive focus on economic opportunities means that making these investments would benefit the economy rather than just reducing demand
- And, understanding energy productivity is key to companies remaining competitive in the global markets going forward (e.g., auto-makers)

Source: MGI analysis

DISTORTING POLICIES AND MARKET IMPERFECTIONS REDUCE ENERGY PRODUCTIVITY CAPTURE

	Examples
Policy distortions	• Fuel subsidies for • Energy subsidies or non-marginal pricing • Lack of financial incentives for public industries
Lack of information	• Consumers unaware of the cost of their energy choices and unable to track performance • Fragmented energy costs often go unmanaged by companies
Agency issues	• Landlords and tenants opting for lower energy productivity when benefits don't accrue to them • Appliances makers don't adopt efficient materials and technologies if scale for upgrade unclear
Financing issues	• High hurdle rates in many commercial and industrial companies • Credit constraints for MUSH and residential segments

Source: MGI analysis

IF CRUDE PRICES REMAIN HIGH, WE COULD SEE GLOBAL PEAK DEMAND FOR PETROLEUM BEFORE 2015

		2005 - 2010 Near-term: Demand Destruction	2010 - 2015 Medium-term: Accelerating Substitution	2015 - 2030 Longer-term: Technology Innovation
Behaviors	**Vehicle miles traveled**	• Falling VMT	• Beginning structural reduction in VMT	• Step change in VMT holds going forward
Substitution	**Biofuels**	• Biofuels as blendstock	• Biofuels as base-stock	• Broad-based substitution
	Fuel oil / diesel	• Secular demand decline	• Accelerating shift away ex. transport	• Almost no oil in power/industrial
	Refining conversion	• Under construction	• On line reducing crude requirements	• Deep conversion for blend components
Innovation	**Engine technology**	• Initial hybrids; market shift to smaller cars	• Accelerating fleet turn (30-40 mpg)	• Fleet efficiency 40-50 mpg
	Policy	• A few subsidies; lots of talk	• Policy responses (CAFE, CO2, specs)	• Regulatory innovation