



Resource Rich Colorado

Colorado's National and Global Position in the Energy Economy

Fourth Edition, December 2012



COLORADO ENERGY COALITION

Resource Rich Colorado

This annual report analyzes Colorado's broad energy industry cluster, in order to illustrate how Colorado stacks up to the competition domestically, and how the U.S. stacks up to the competition internationally.



COLORADO ENERGY COALITION

Resource Rich Colorado

Acknowledgements

Competitive Analysis Committee Members

Chris Hansen, IHS, Committee Chair

John Armstrong, Enserca LLC.

Beth Chacon, Xcel Energy

Brian Payer, URS Corporation

Matthew T. Palmer, Encana Marketing (USA) Inc.

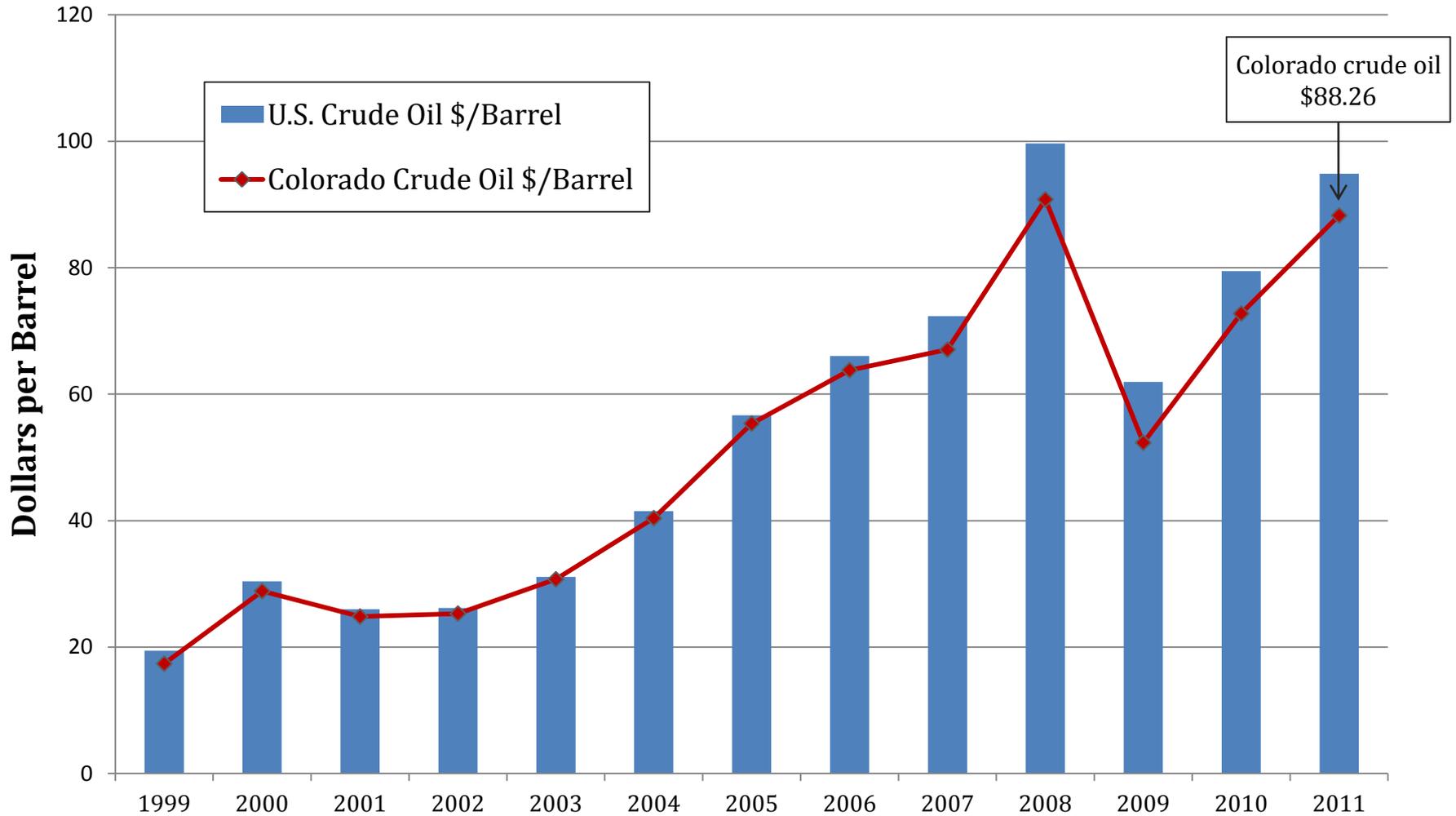
Larry Holdren, Pure Brand Communications

Oil



Crude Oil Prices, 1999-2011

Colorado produced oil prices trend below the national average;
U.S. average price in 2011 was \$94.88 per barrel

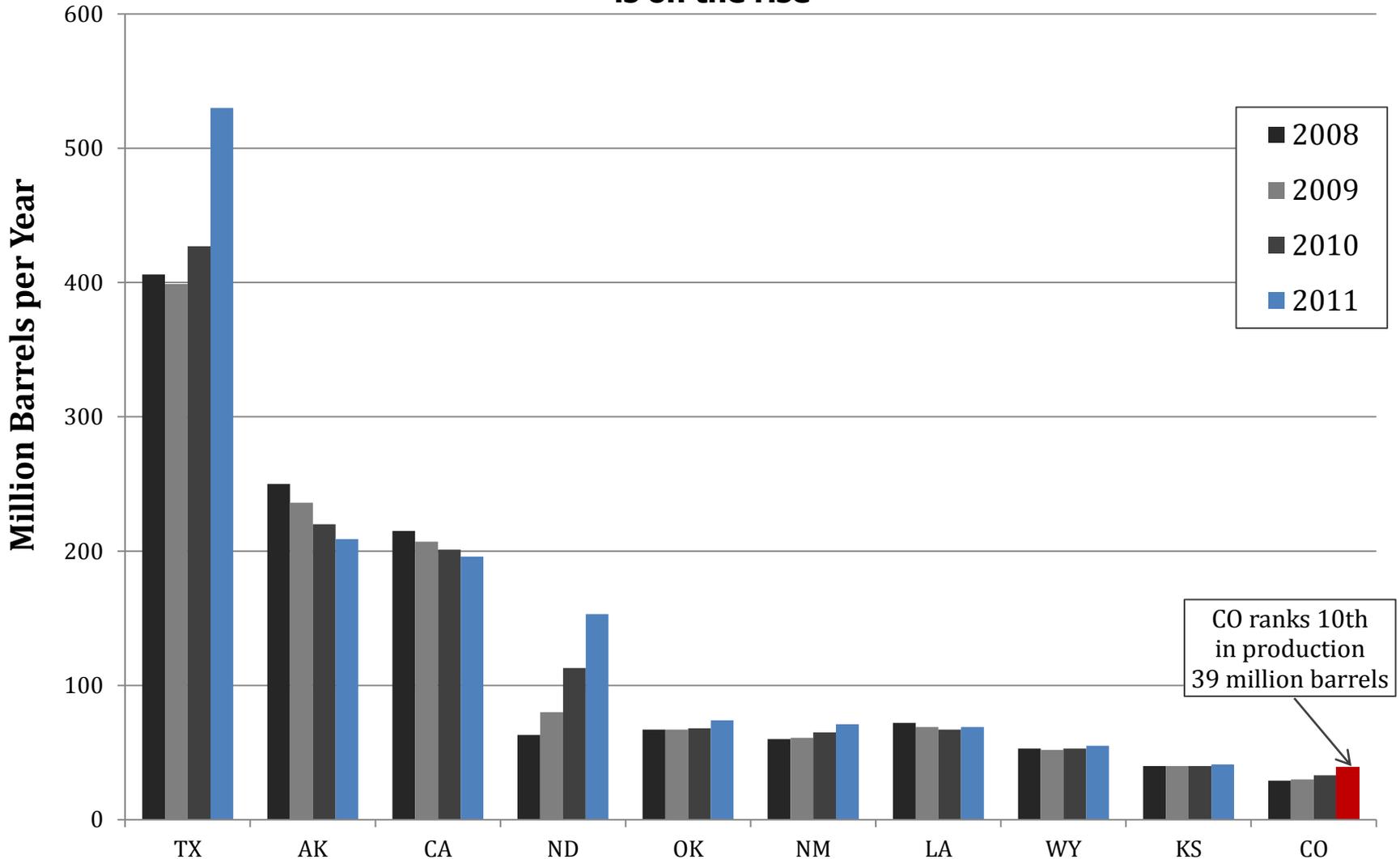


Source: U.S. Department of Energy, OK-WTI, Energy Information Administration

Fig. 1

Crude Oil Production by State, 2008-2011

Colorado ranks 10th in crude oil production; Colorado production is on the rise



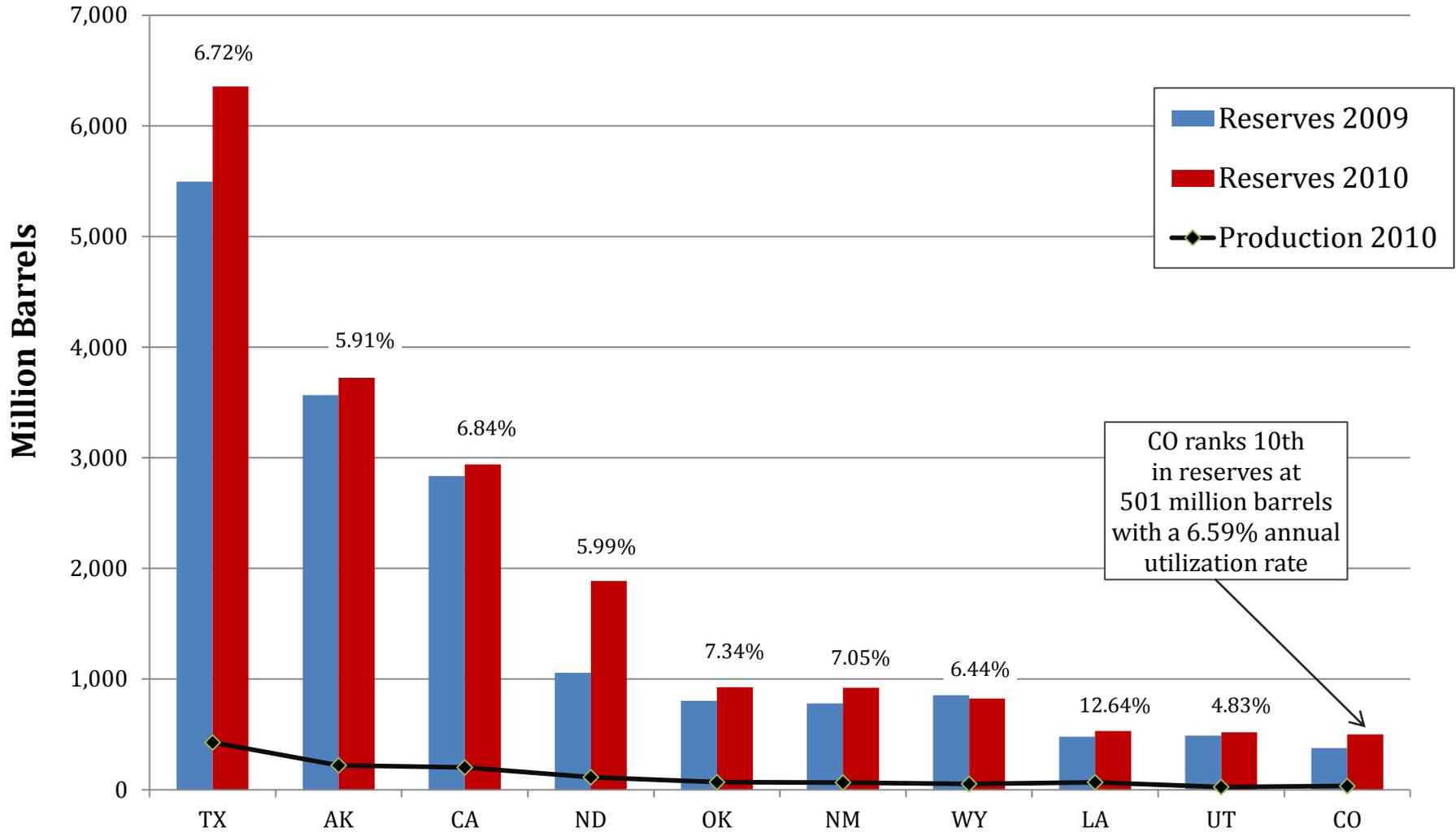
Source: U.S. Department of Energy, Energy Information Administration

Note: Crude oil includes all liquid hydrocarbons at surface, including lease condensates

Fig. 2

Crude Oil Reserves & Utilization Rate

Technology improvements contribute to growing reserves

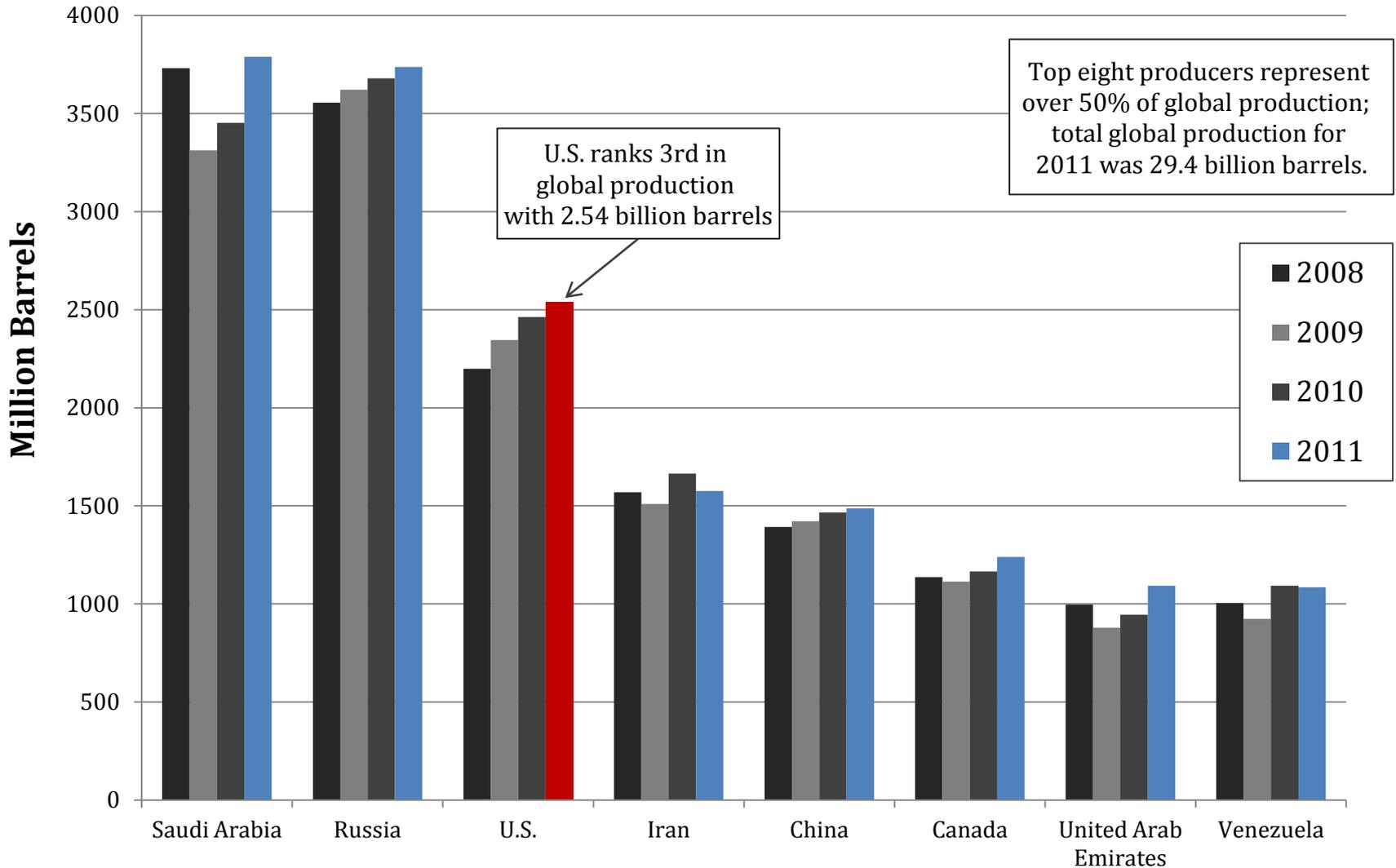


Source: U.S. Department of Energy, Energy Information Administration

Note: Utilization rate is the amount of reserves developed/produced annually; crude oil reserves include lease condensate

Oil Production Leaders, 2008-2011

U.S. ranks 3rd in production; domestic production on the rise

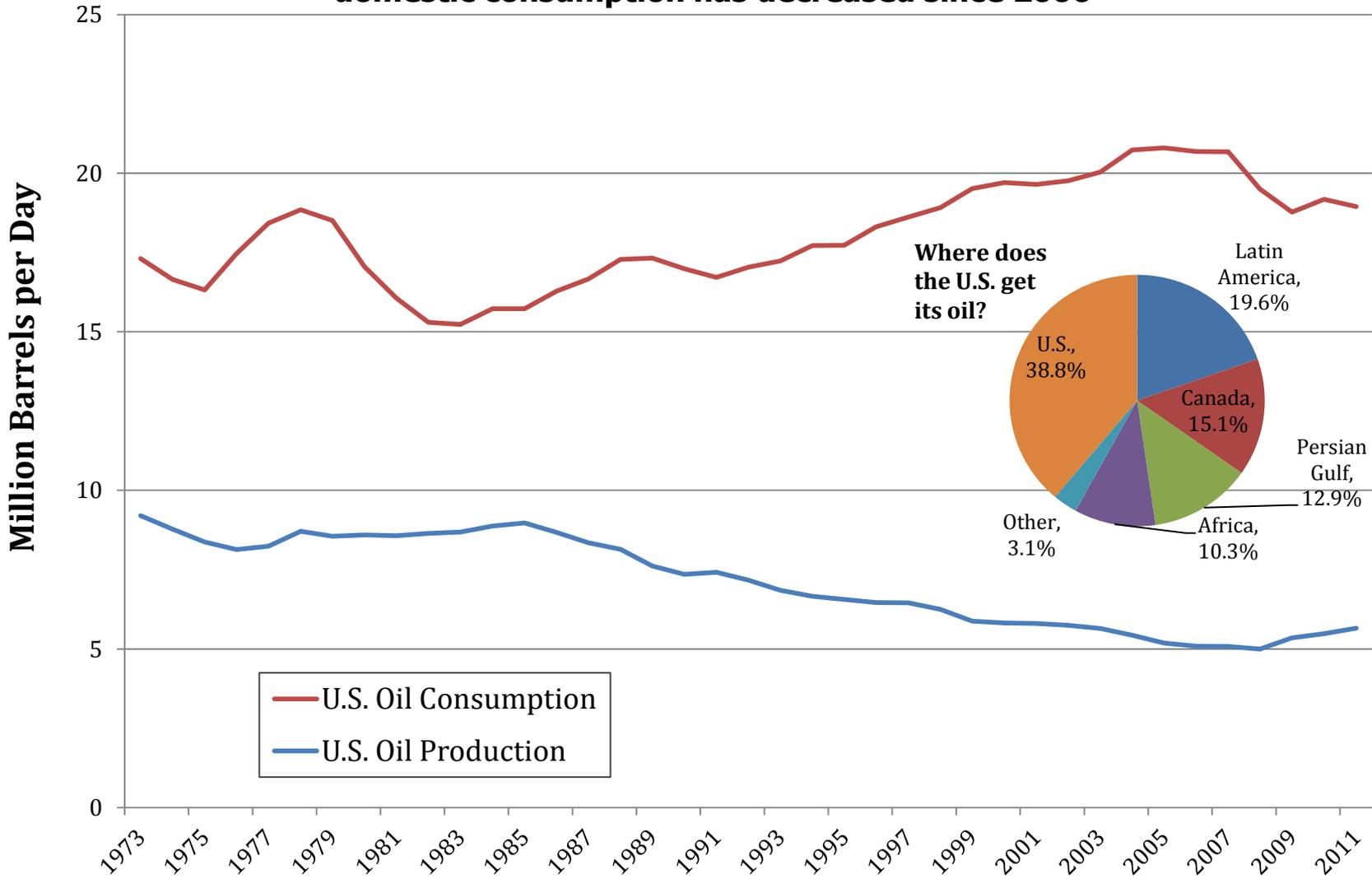


Source: International Energy Agency (IEA), 2009-2012 Key World Energy Statistics
 Note: Includes crude oil, natural gas liquids, feedstocks, additives, and other hydrocarbons

Fig. 4

U.S. Crude Oil Production & Consumption, 1973-2011

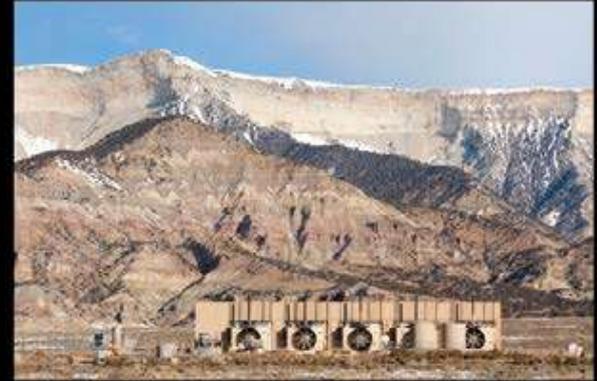
The gap is narrowing, as domestic production has increased since 2009 and domestic consumption has decreased since 2006



Source: U.S. Department of Energy, Energy Information Administration; NPR in conjunction with Nelson Hsu

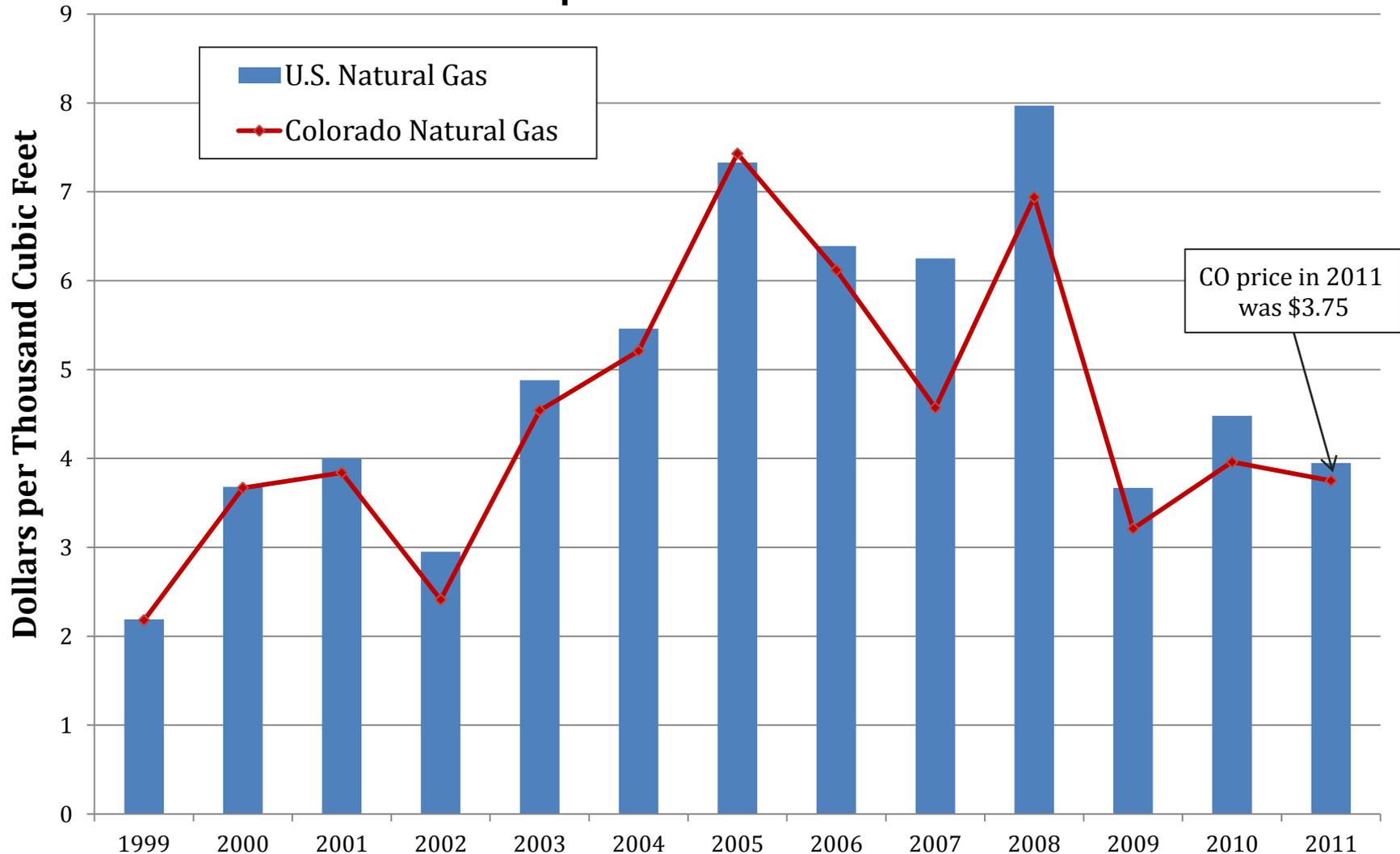
Fig. 8

Natural Gas



Natural Gas Wellhead Prices, 1999-2011

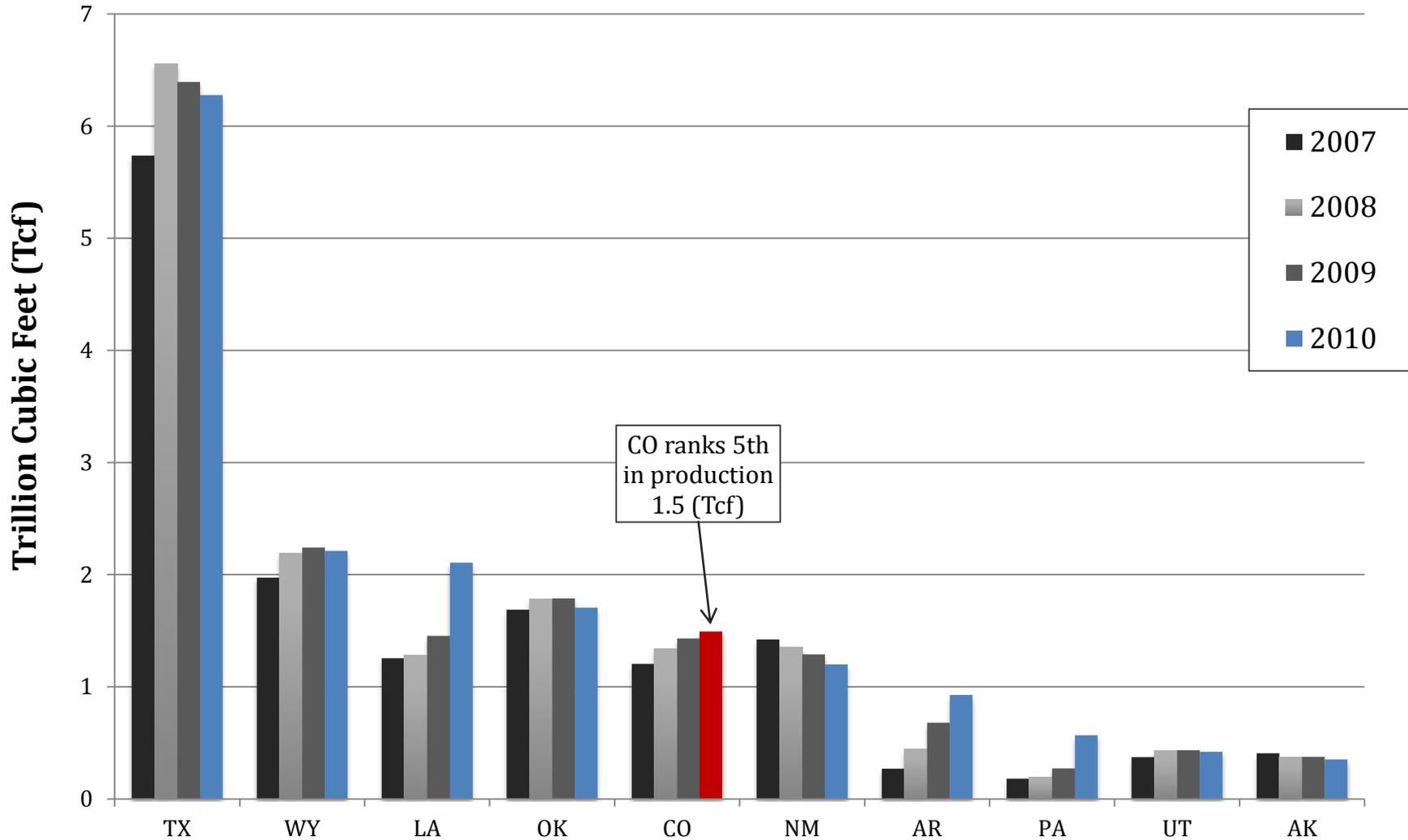
The Colorado price trends below the national average to account for fuel transportation costs to markets outside the state



Source: U.S. Department of Energy, Energy Information Administration

Natural Gas Production by State, 2007-2010

Colorado ranks 5th in production; production is increasing due to resource development technology improvements

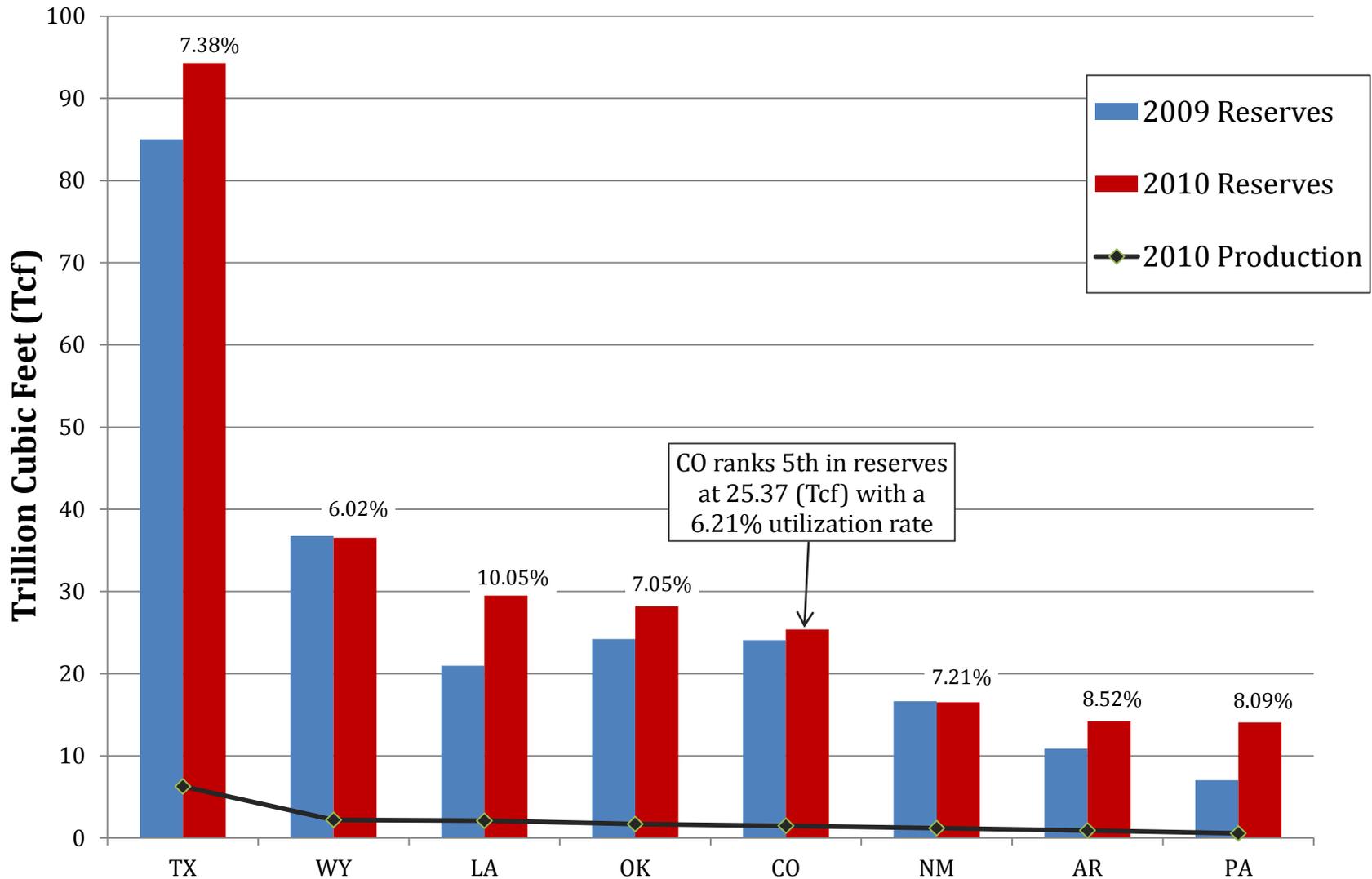


Source: U.S. Department of Energy, Energy Information Administration

Note: Top 10 producers including Colorado

Natural Gas Reserves & Utilization Rate

Technology is contributing to growing reserves nationwide

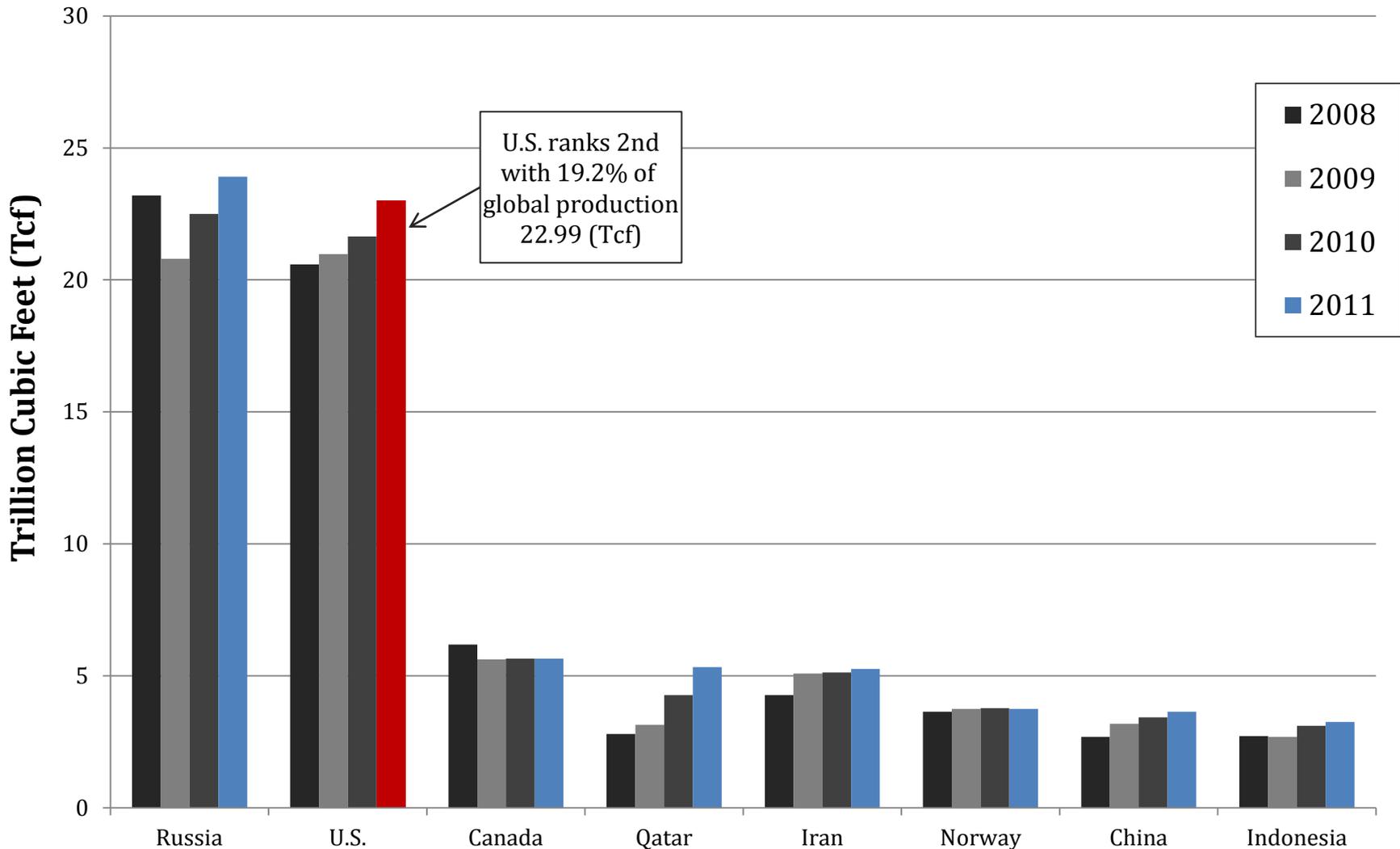


Source: U.S. Department of Energy, Energy Information Administration

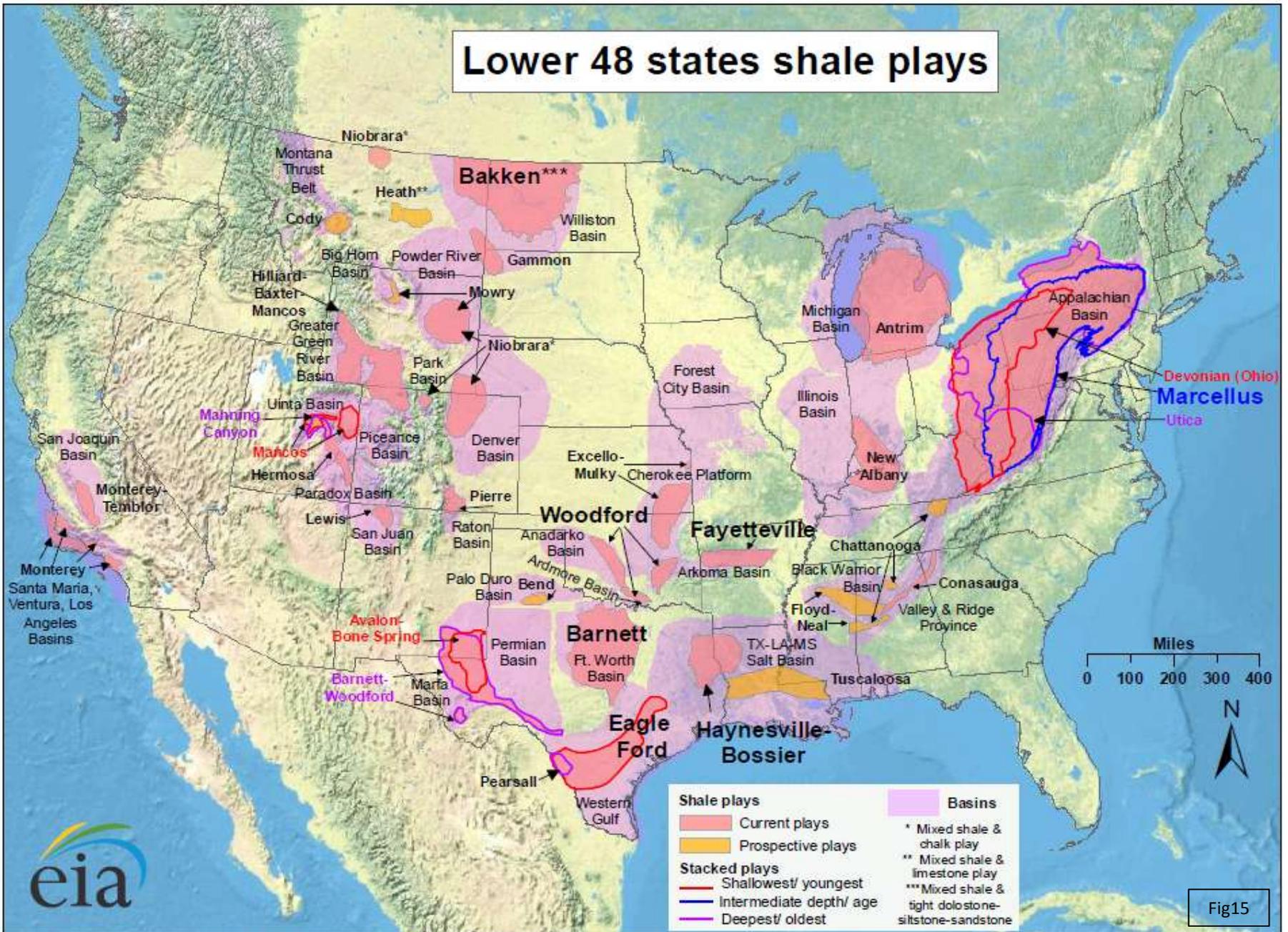
Note: Top eight states including Colorado; utilization rate is the amount of reserves developed/produced annually

Natural Gas Production Leaders, 2008-2011

U.S. is 2nd and growing; top 8 producers equal 61.6% of global production



Lower 48 states shale plays

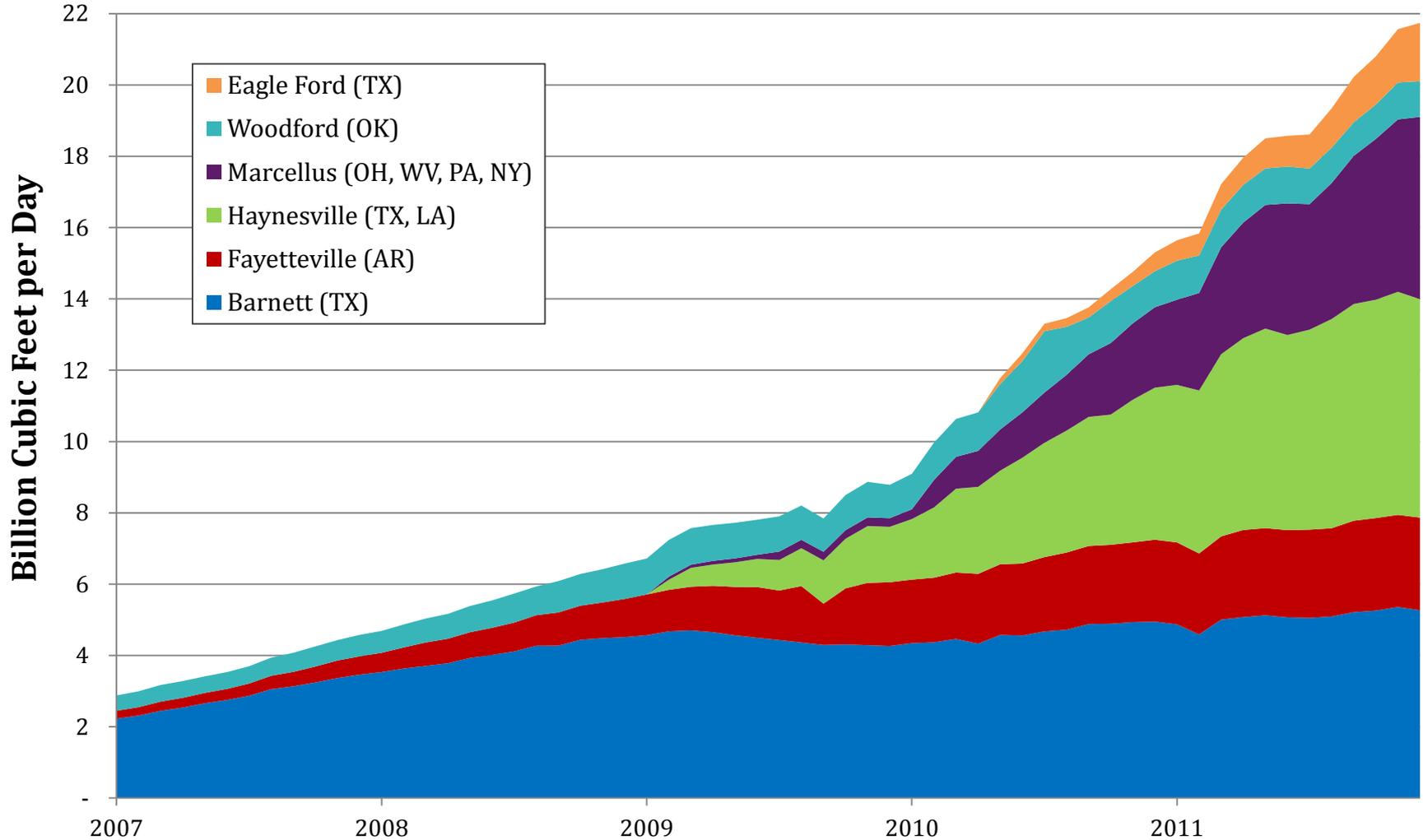


Source: Energy Information Administration based on data from various published studies.
 Updated: May 9, 2011

Fig15

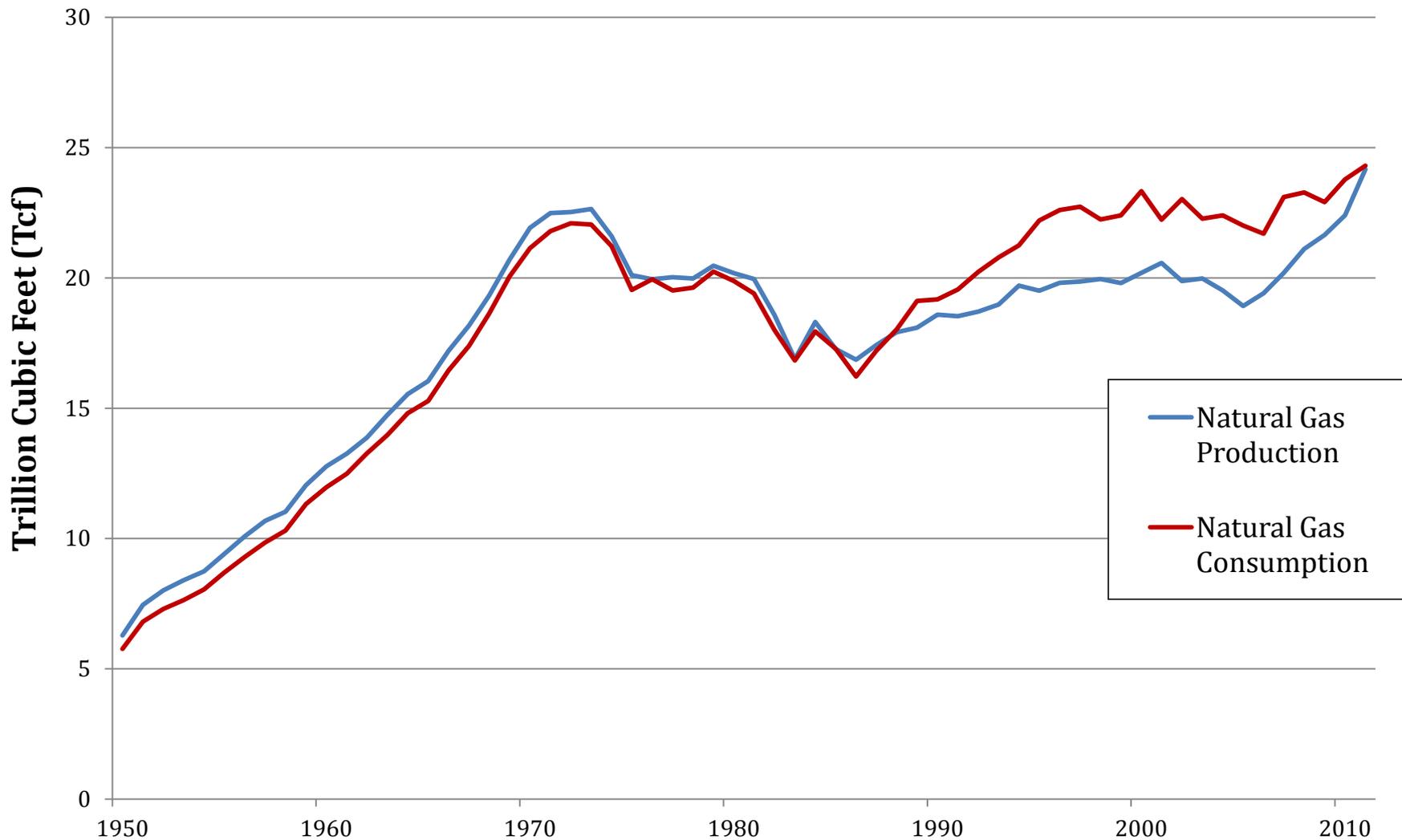
U.S. Shale Gas Production by Major Resource Play

Technology has led to quickly expanding resource development



U.S. Natural Gas Production & Consumption

Domestic production has increased steadily since 2006

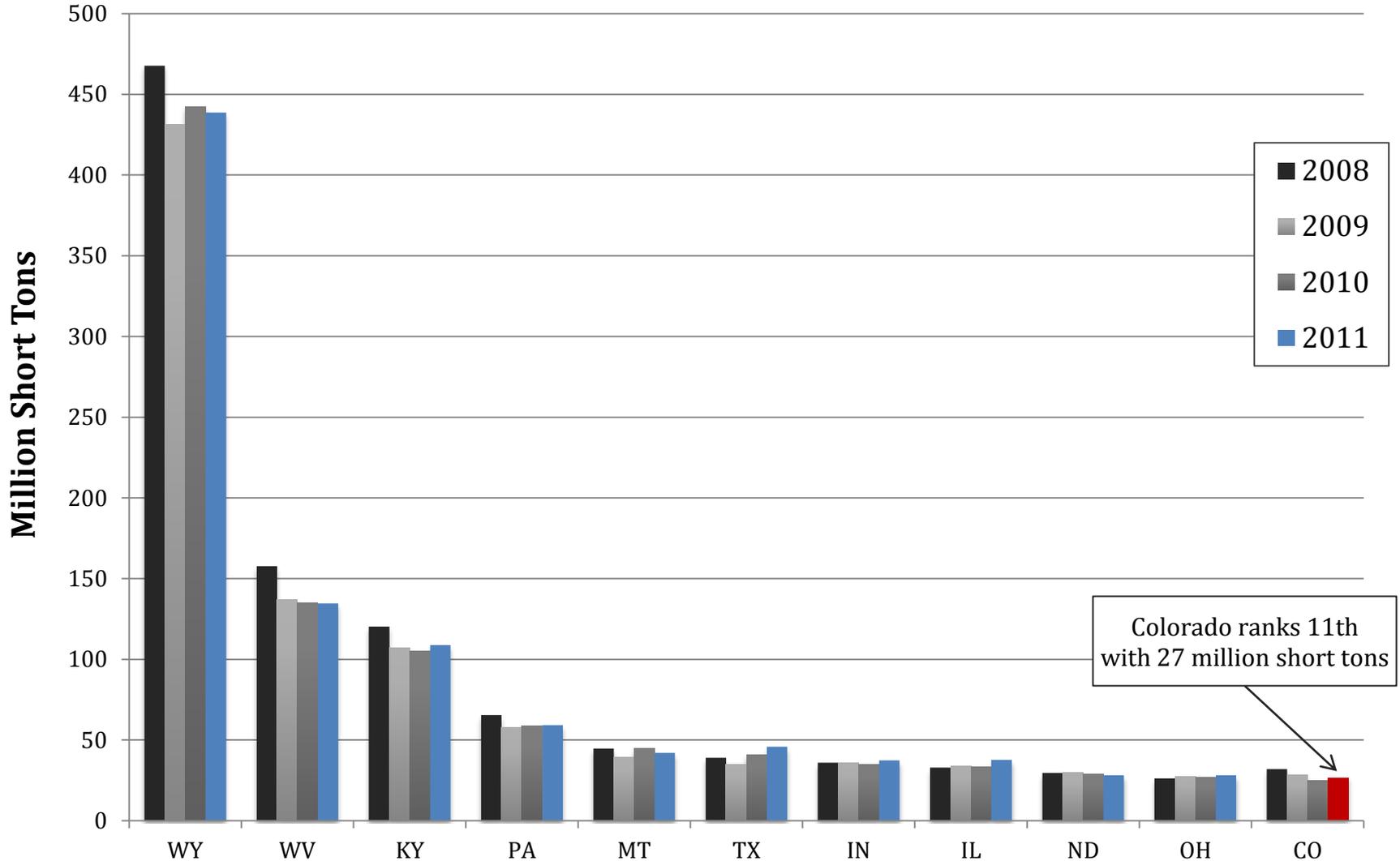


Coal



U.S. Coal Production by State, 2008-2011

Colorado coal production recovering after low point in 2010

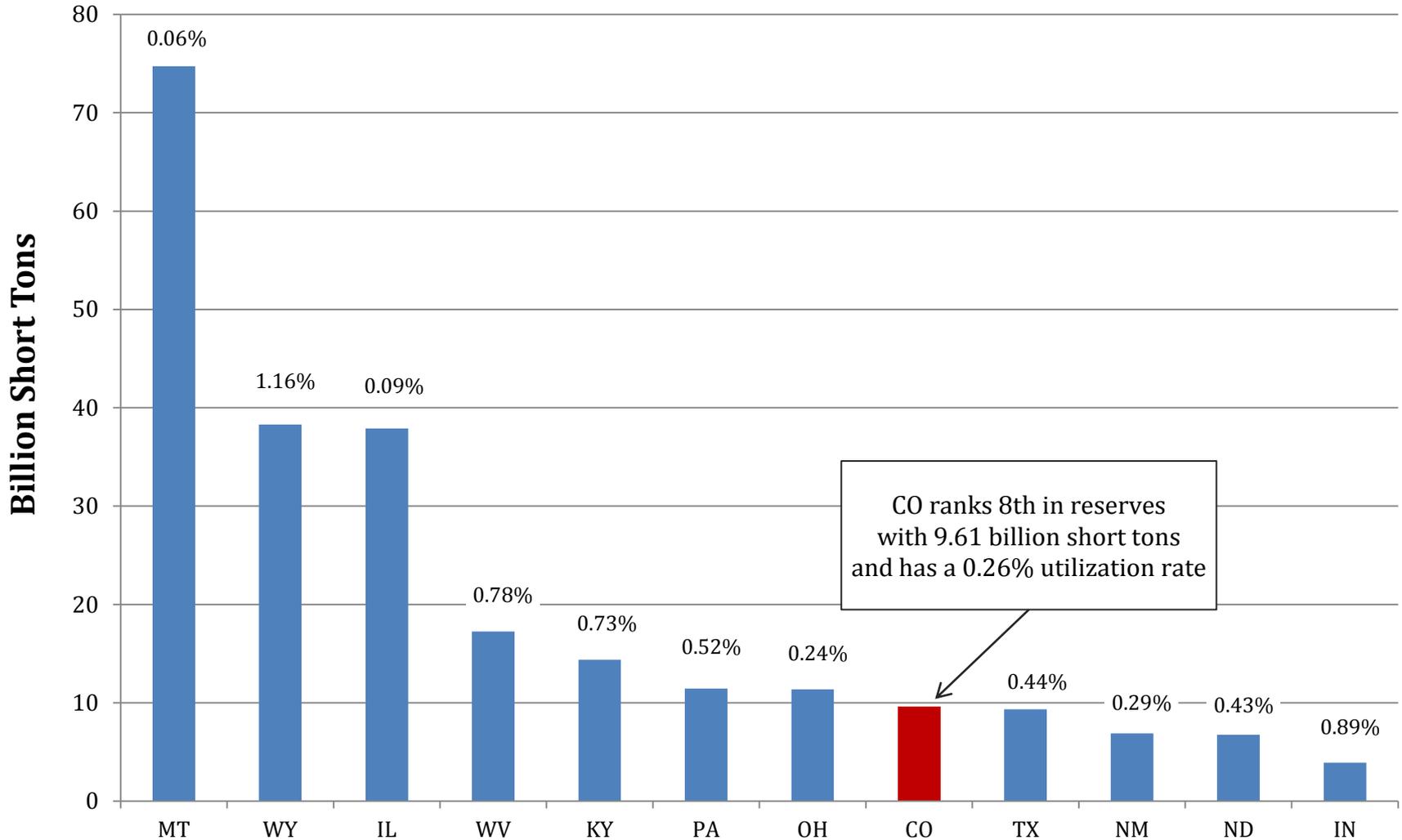


Source: U.S. Department of Energy, Energy Information Administration
Note: Top 10 states plus Colorado; short ton equals 2,000 pounds

Fig . 20

U.S. Coal Reserves & Utilization Rate, 2010

Percent equals utilization rate of state reserves; coal reserves are massive, contributing to an extremely small utilization rate

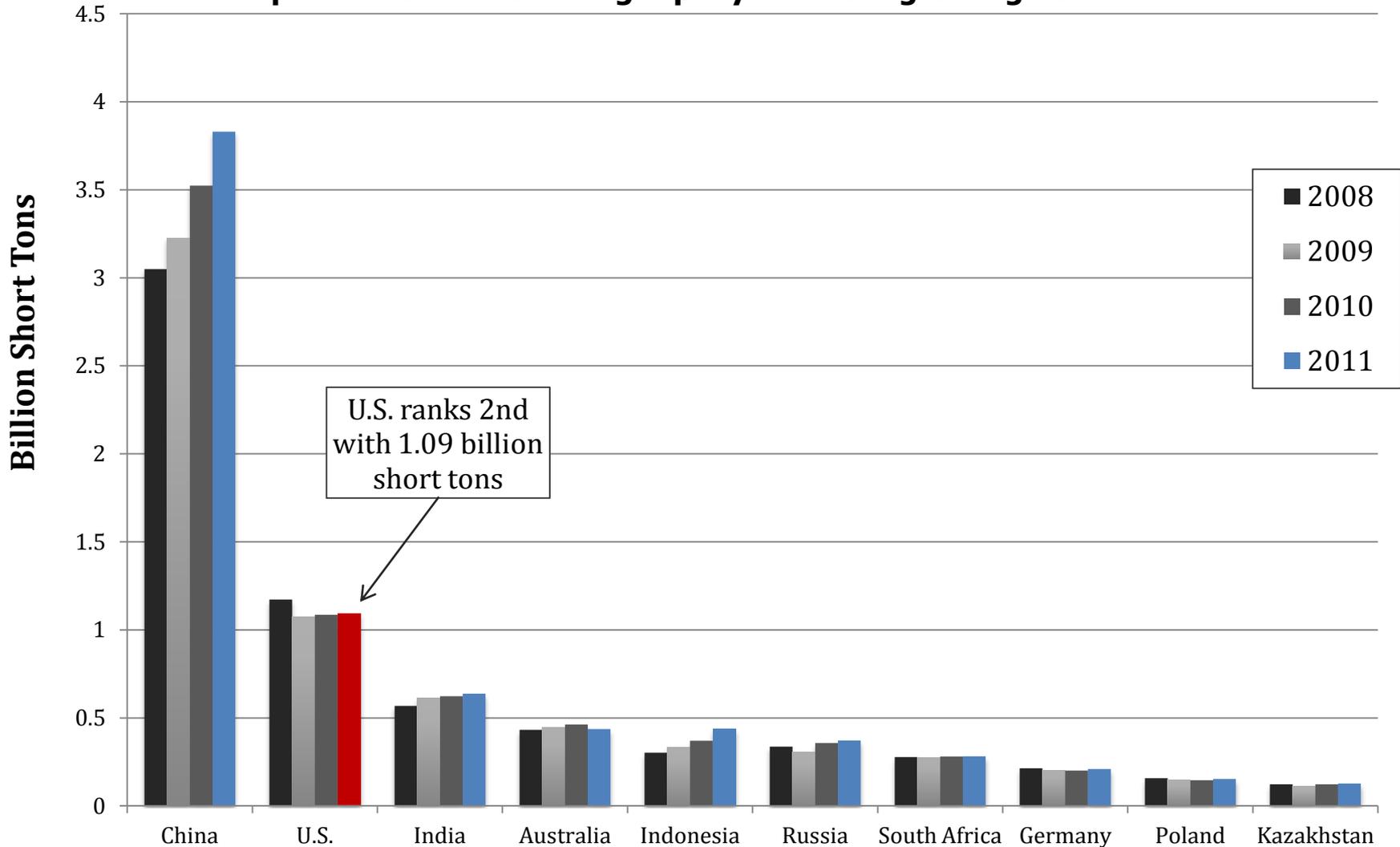


Source: U.S. Department of Energy, Energy Information Administration;

Note: Reserves are "Estimated Recoverable Reserves"; short ton equals 2,000 pounds; 2010 is most recent year for domestic coal reserves data

Global Coal Production Leaders, 2008-2011

U.S. production holding steady as resource diversity expands; China coal production is increasing rapidly to match growing demand



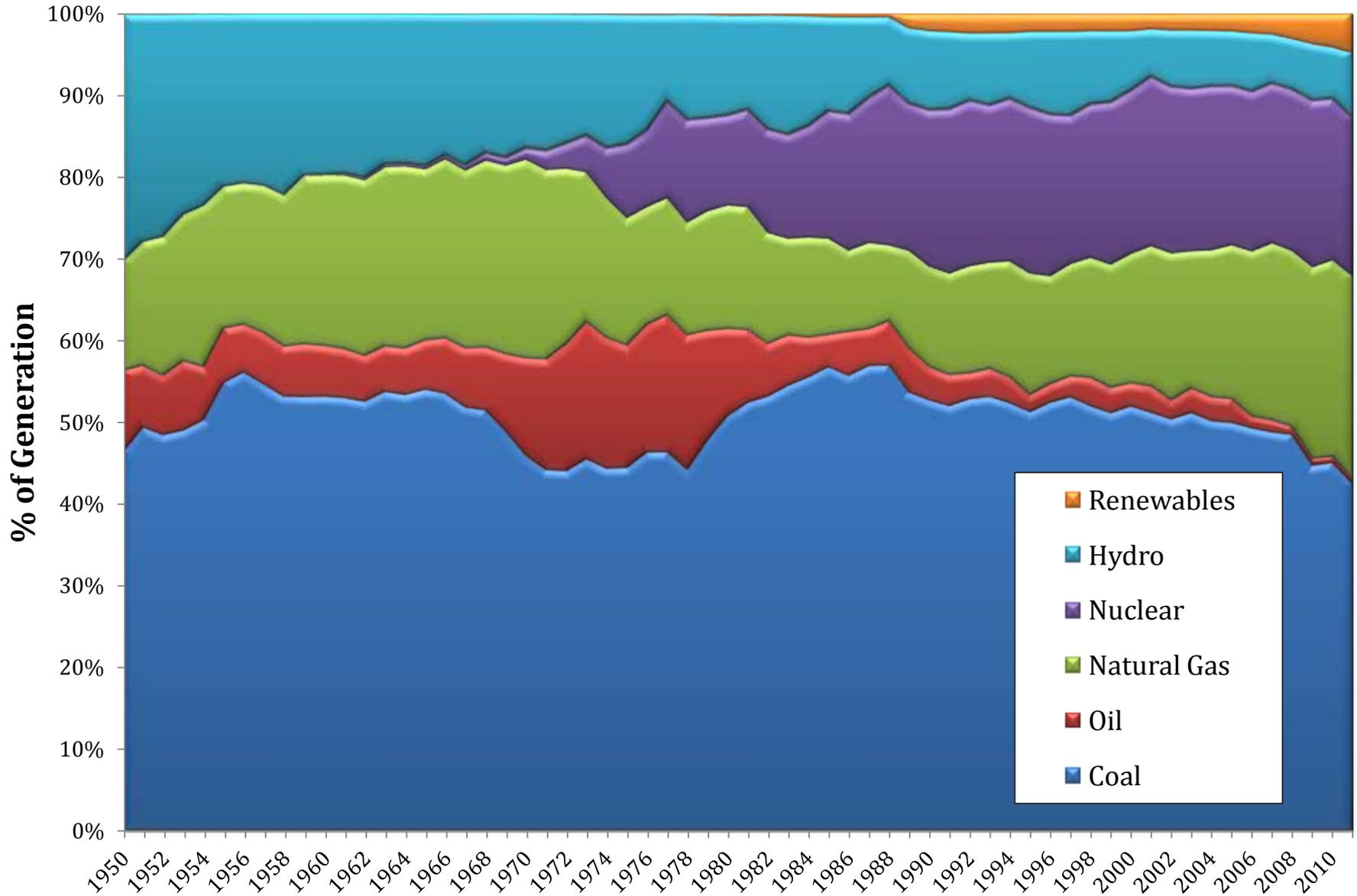
Source: U.S. Department of Energy, Energy Information Administration

Fig. 22

Power



Net Generation History by Resource, 1950-2012

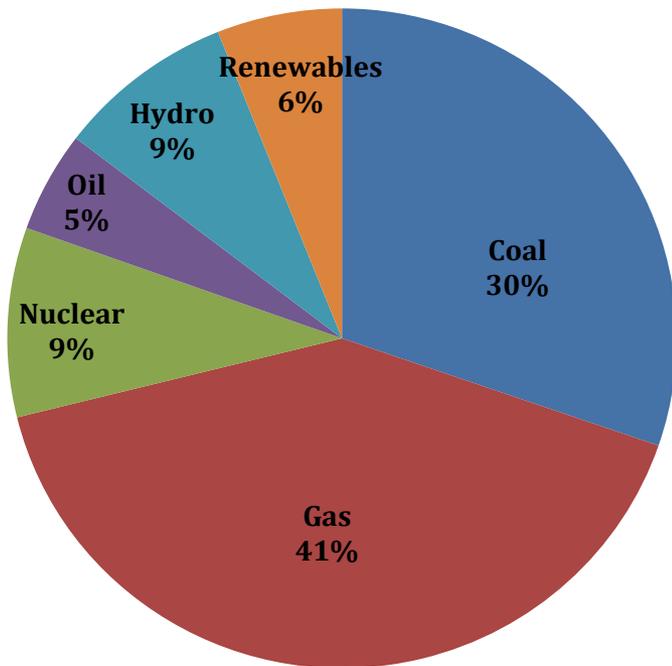


Source: U.S. Department of Energy, Energy Information Administration

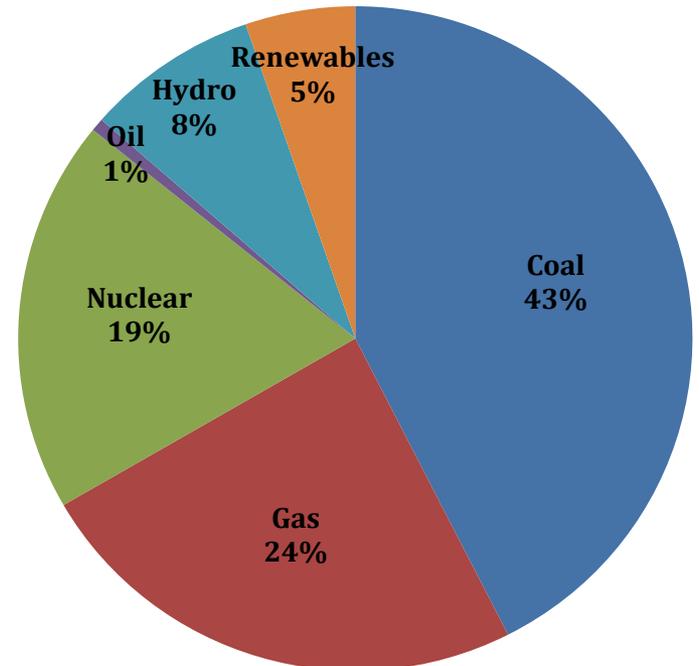
U.S. Nameplate Capacity vs. Net Generation, 2011

Available installed capacity versus utilized capacity

U.S. Operating Nameplate Capacity by Resource
1.14 terawatts of installed capacity



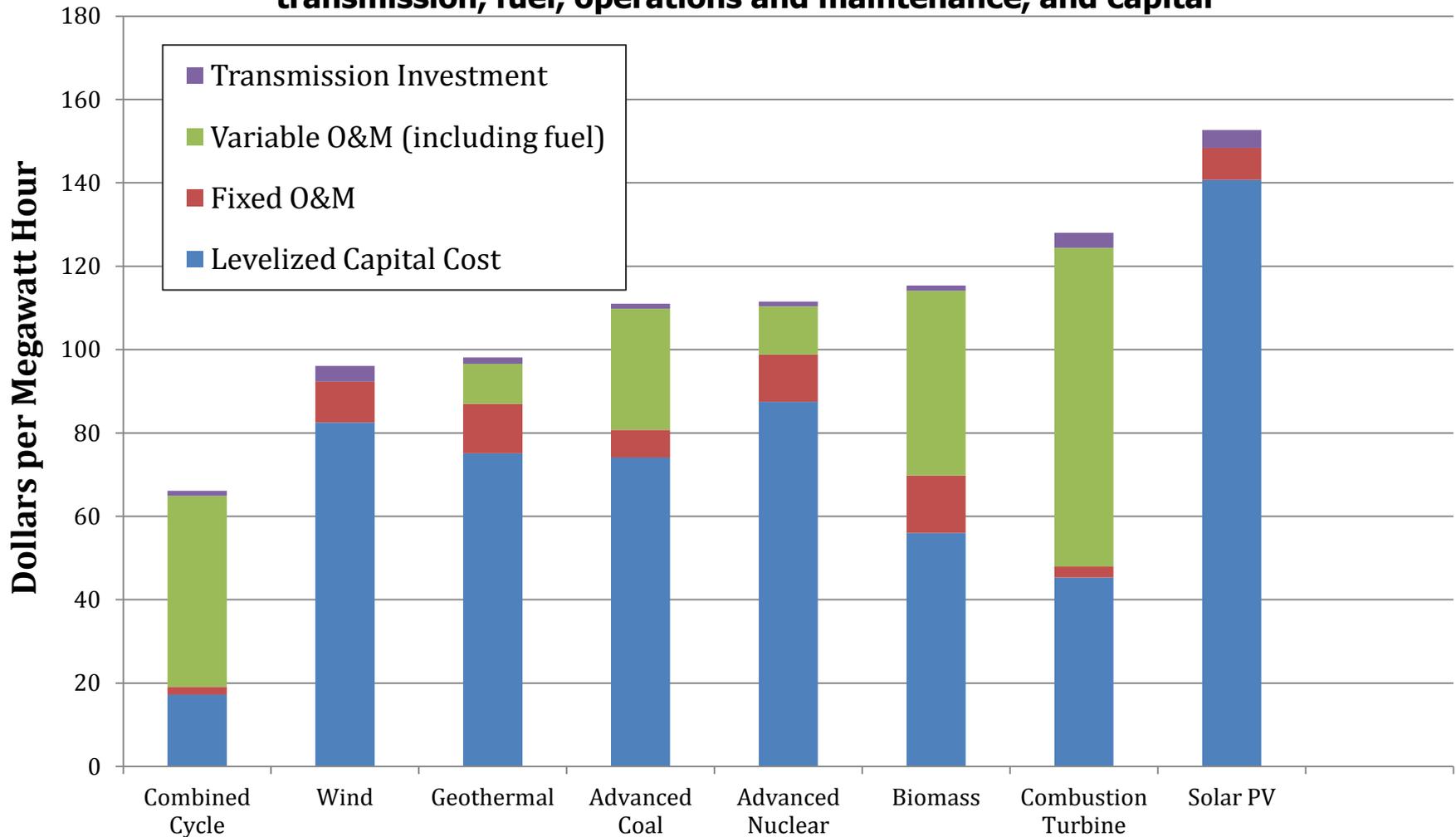
U.S. Net Generation by Resource
4,123 terawatt hours of total generation



Source: U.S. Department of Energy; Energy Information Administration

Levelized Costs for Electric Generation Plants

Assuming a plant start date of 2017, the total levelized cost measures competitiveness of different generating technologies; levelized costs include transmission, fuel, operations and maintenance, and capital

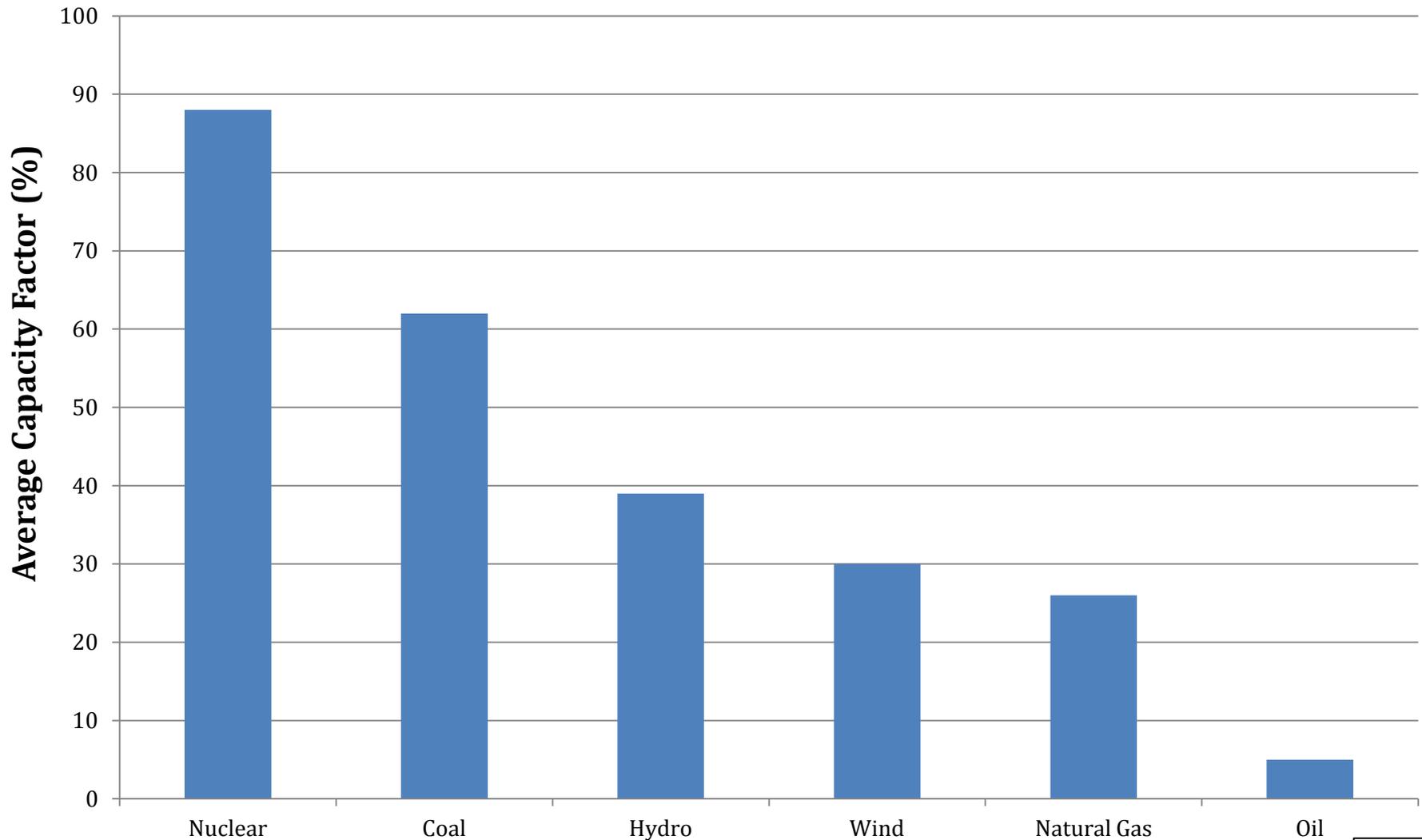


Source: U.S. Department of Energy, Energy Information Administration

Note: 2017 is referenced due to the long lead time required for some technologies and projects; estimates expressed above will vary by region

Average U.S. Capacity Factor by Resource, 2011

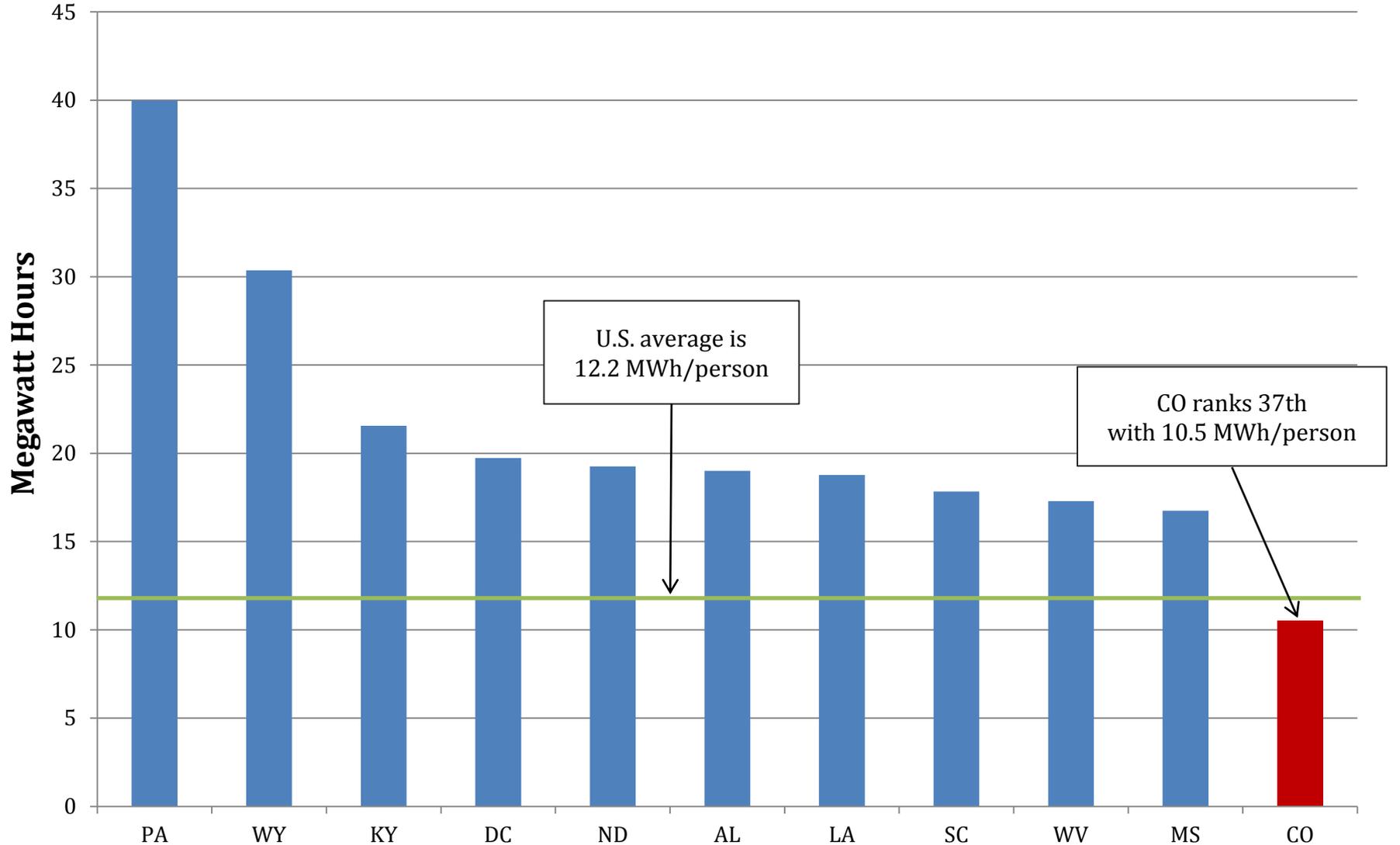
The average capacity factor of a power plant is the ratio of actual output per year compared to the output of operating at full nameplate capacity



Source: U.S. Department of Energy, Energy Information Administration

U.S. Per Capita Electricity Consumption, 2010

Colorado has a low electricity (MWh) consumption rate per person

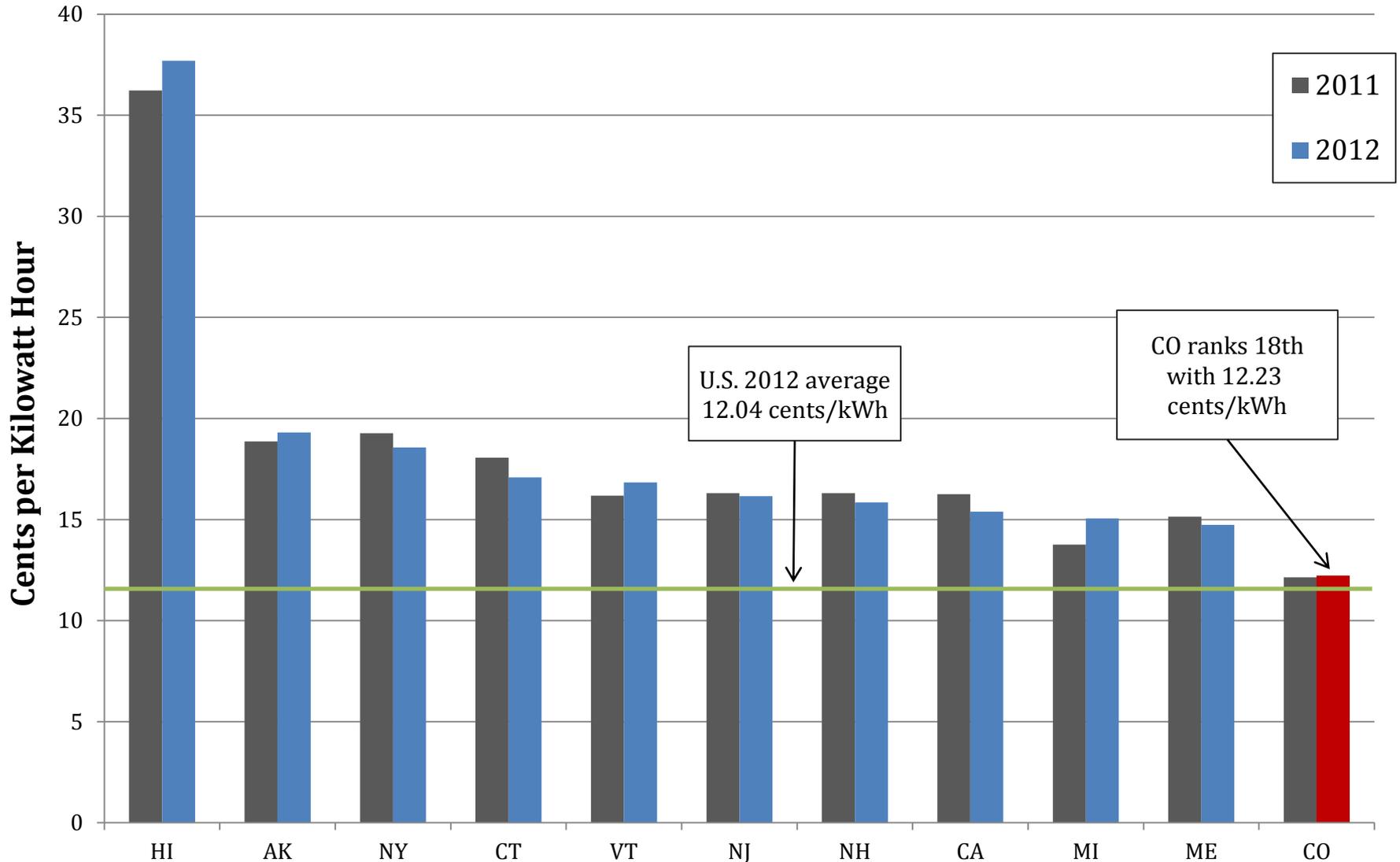


Source: U.S. Census; U.S. Department of Energy, Energy Information Administration

Note: Top 10 states plus Colorado

Average Residential Retail Electric Price, 2011-2012

Colorado has the 18th most expensive residential retail electricity price



Source: U.S. Census; U.S. Department of Energy, Energy Information Administration

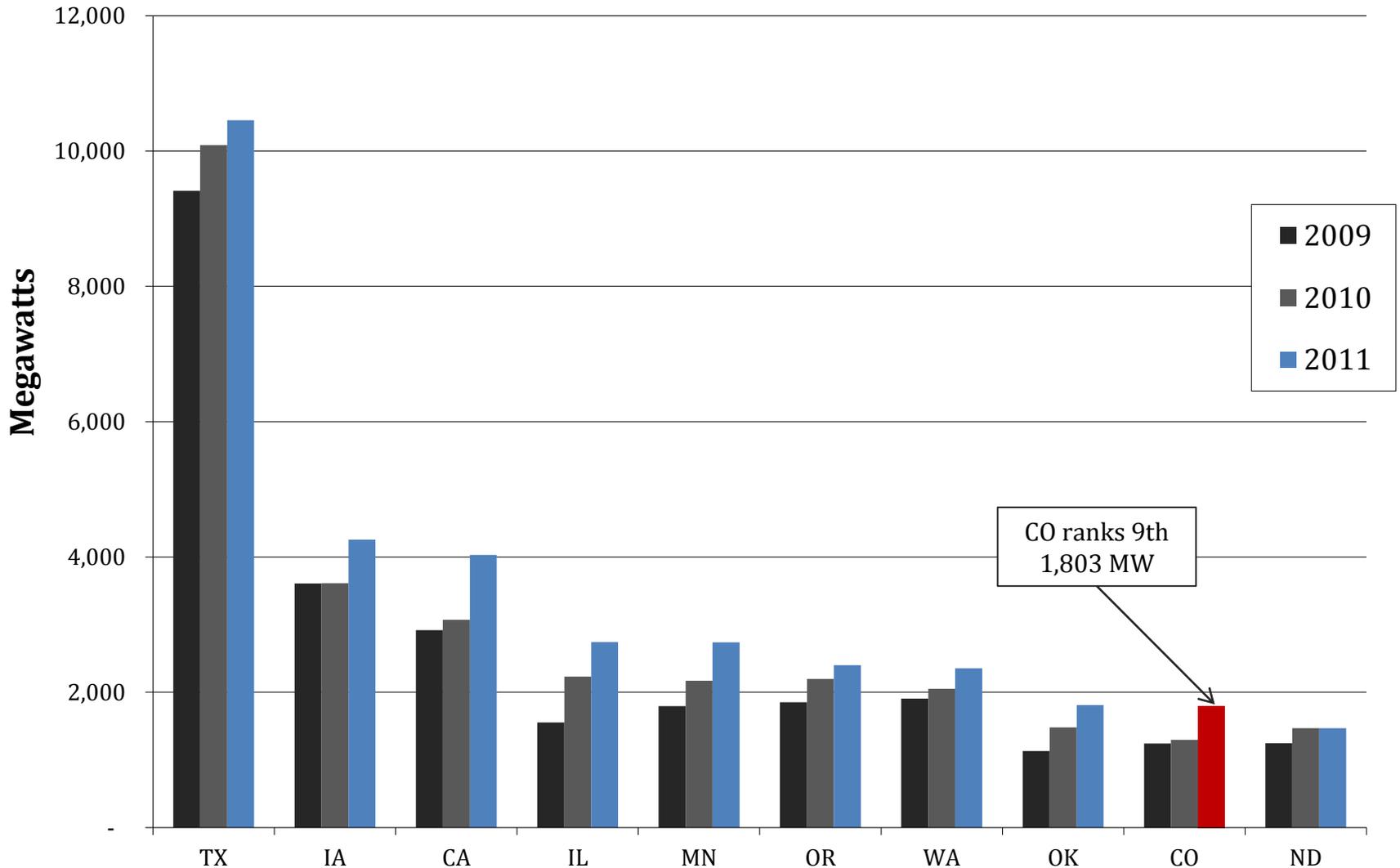
Note: Top 10 states plus Colorado

Renewables



Total Installed Wind Capacity, 2009-2011

Widespread growth in wind installations; Texas is leading the way

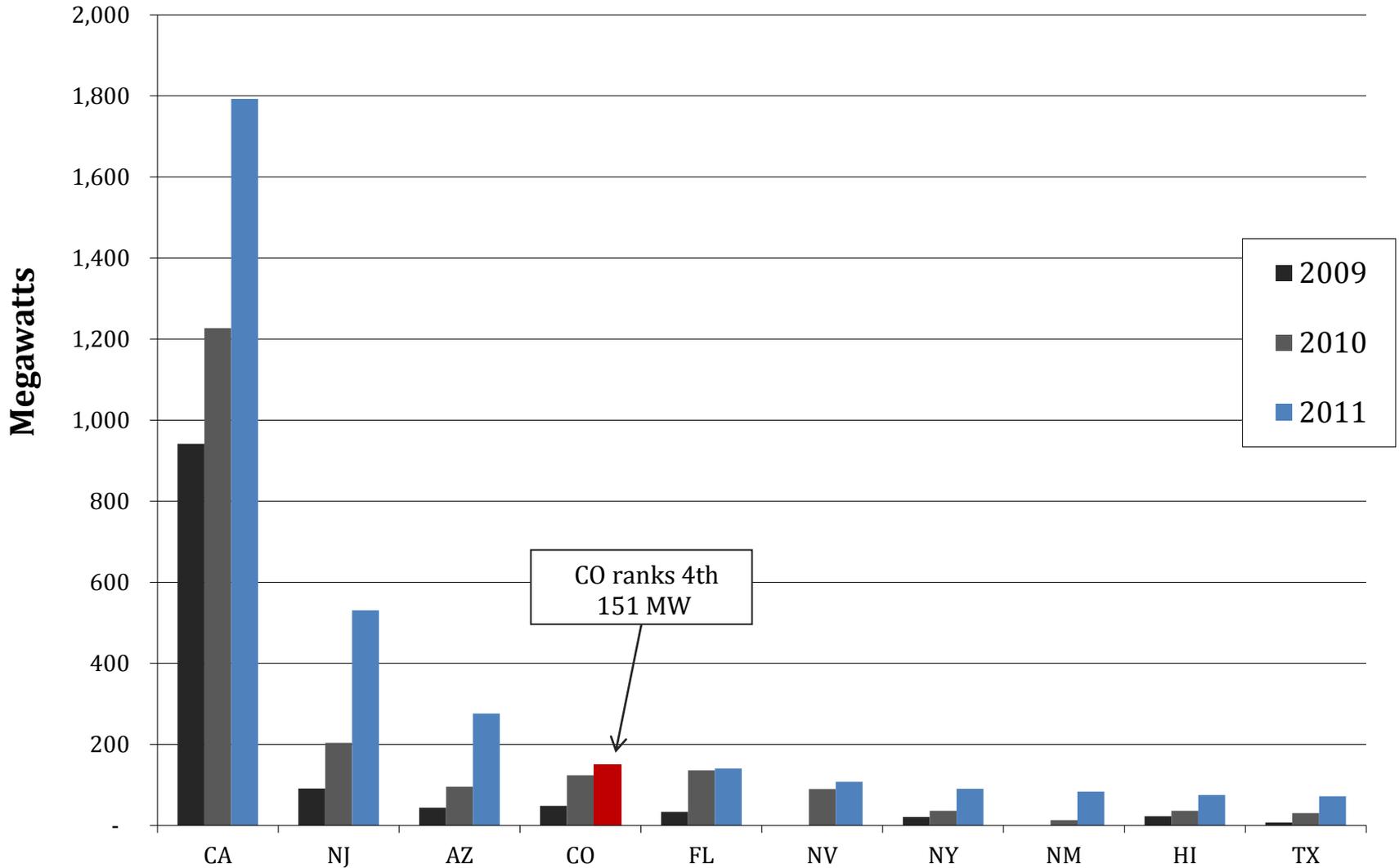


Source: SNL Energy

Fig. 26

Total Installed Solar Capacity, 2009-2011

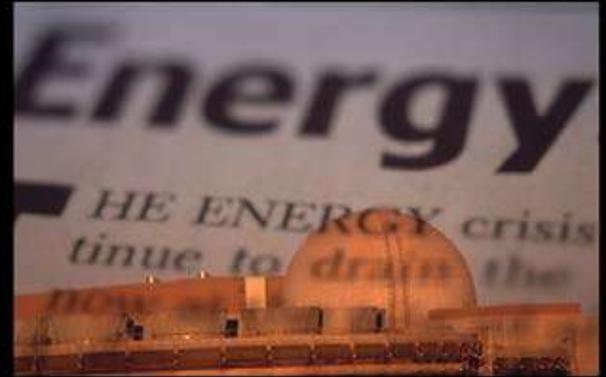
Significant growth in solar installations; California is leading the way



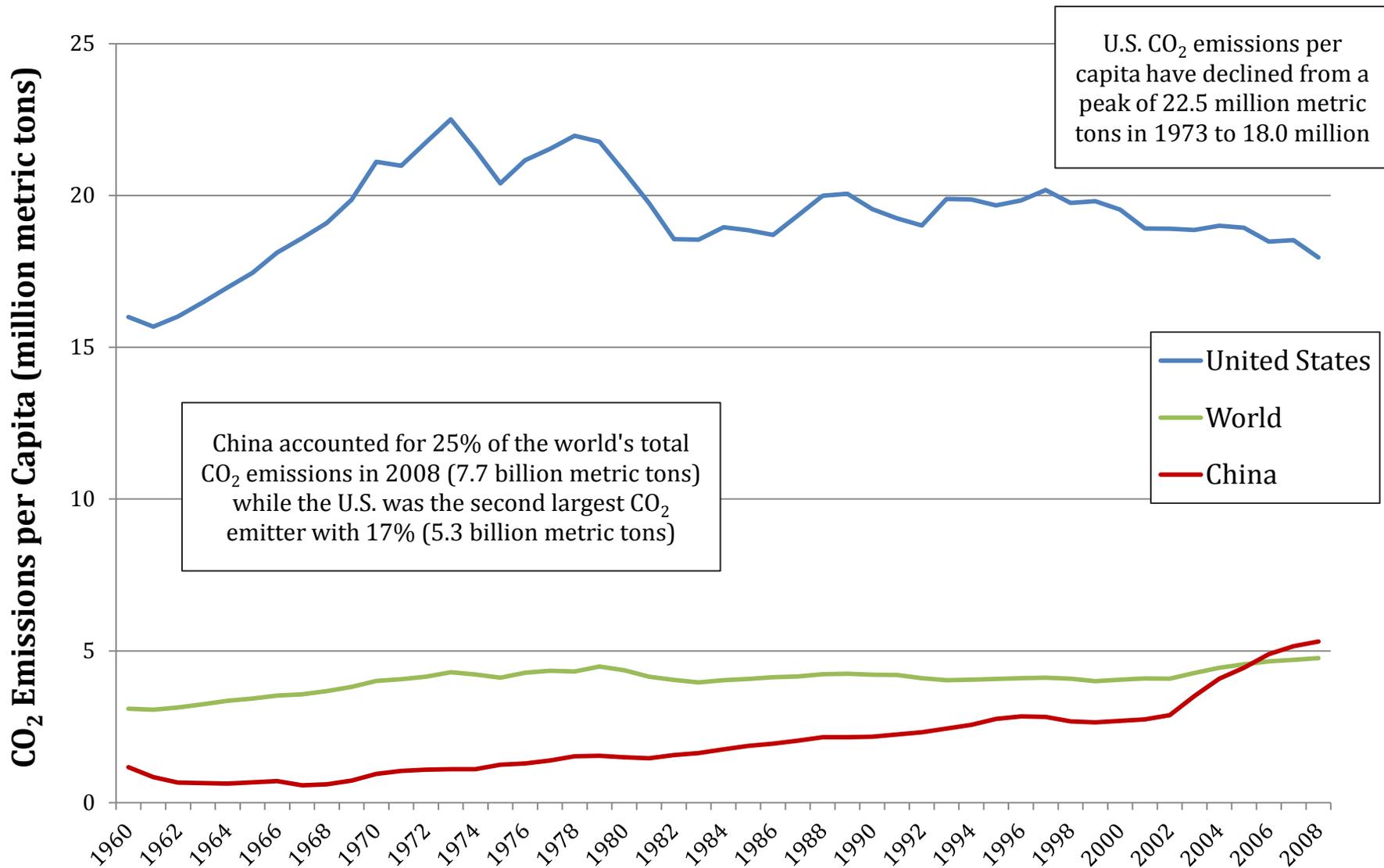
Source: Solar Electric Power Association

Fig. 27

Energy Policies & Programs



CO₂ Emissions Per Capita, 1960-2008



Source: Carbon Dioxide Information Analysis Center, Environmental Sciences Division, Oak Ridge National Laboratory

Energy Efficiency Policies, 2012

Colorado requires electricity sales and demand to be reduced by 5% of 2006 numbers by 2018; natural gas savings requirements vary by utility

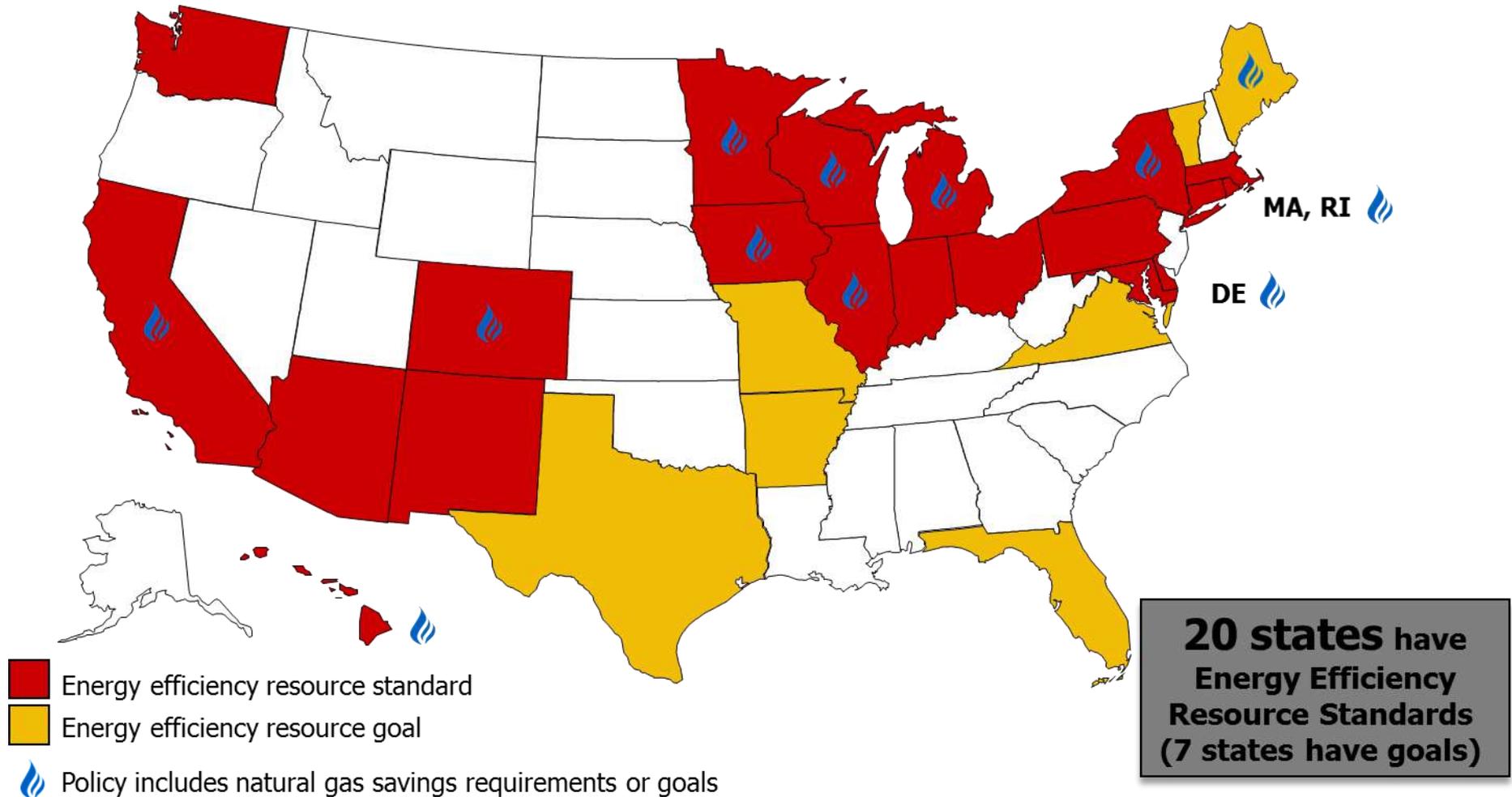
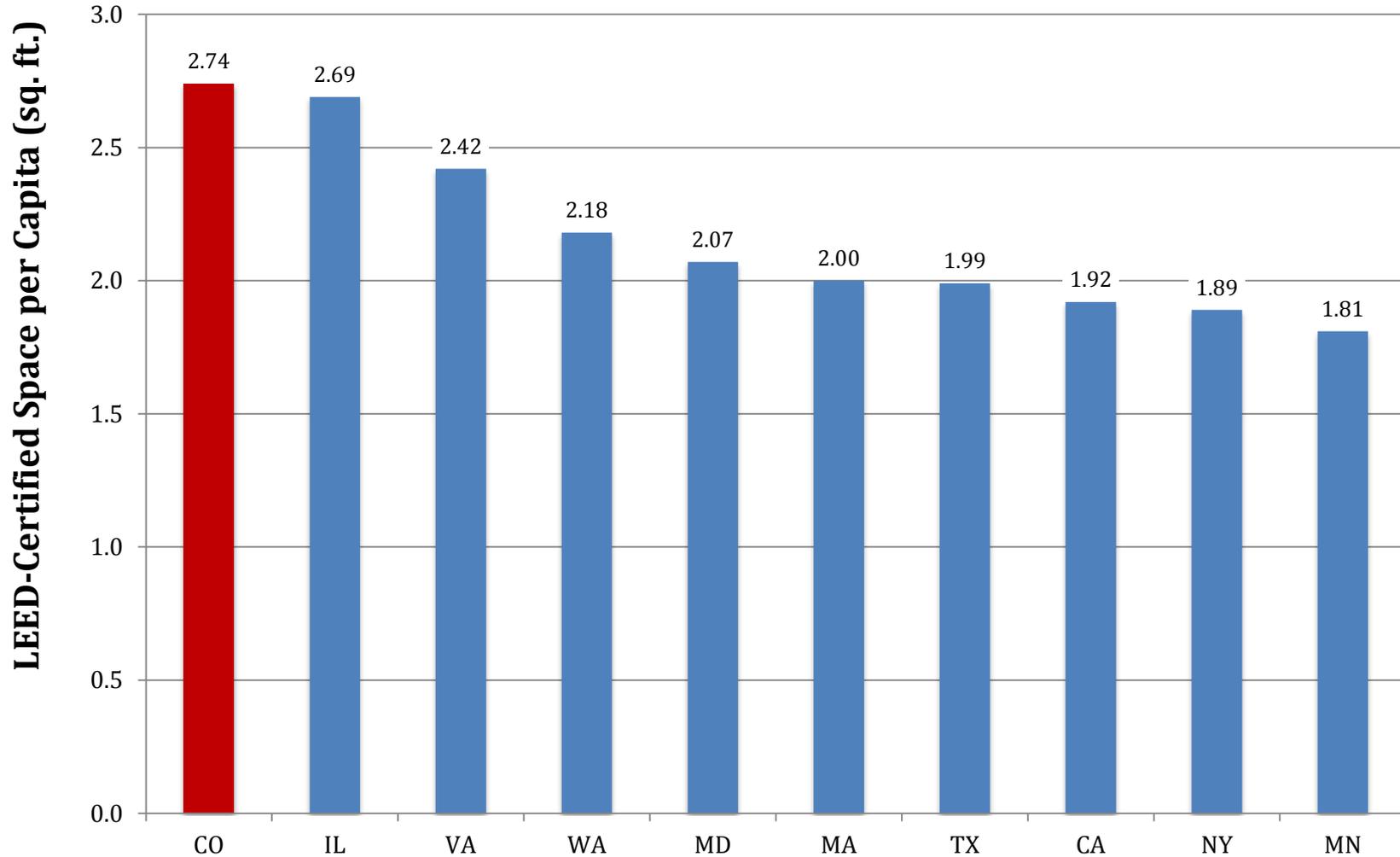


Fig. 47

Source: Database of State Incentives for Renewables & Efficiency (DSIRE)

Square Footage of LEED-Certified Space, 2011

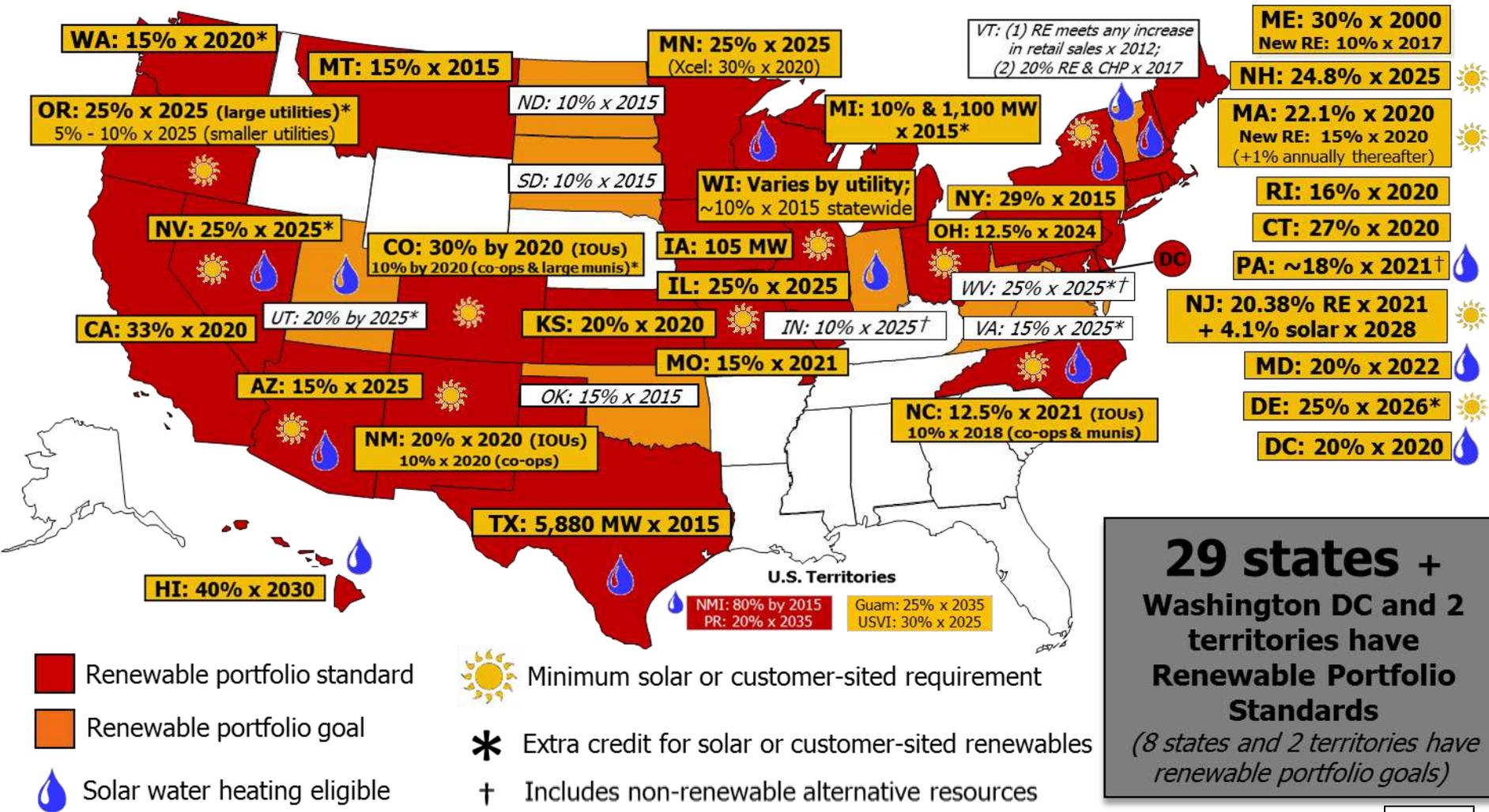
Colorado has highest amount of LEED-certified space per capita



Source: U.S. Green Building Council

Renewable Energy Policies, 2012

Colorado has a Renewable Portfolio Standard (RPS) of 30% by 2020 for investor owned utilities and 10% by 2020 for rural cooperatives and large munis



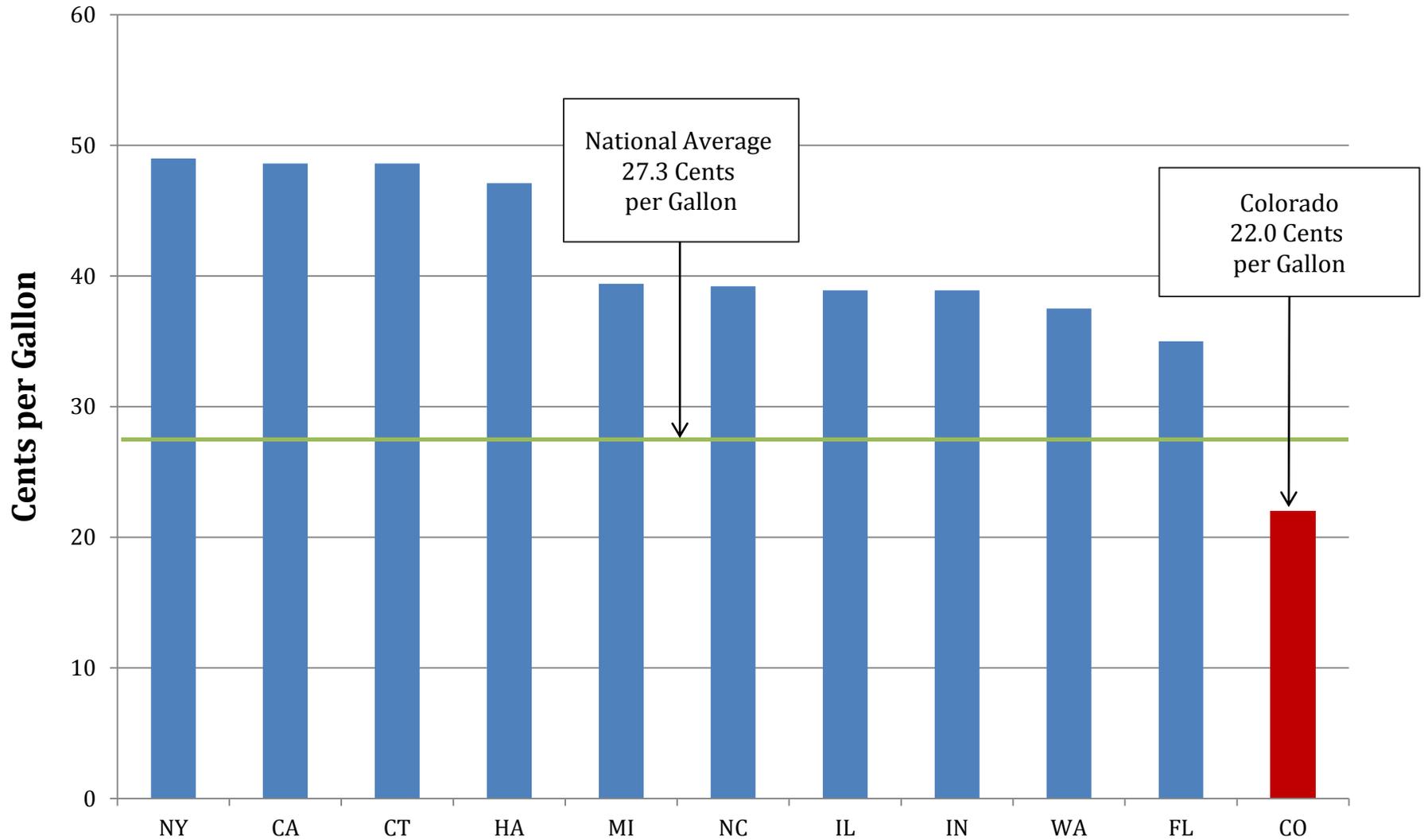
29 states + Washington DC and 2 territories have Renewable Portfolio Standards
(8 states and 2 territories have renewable portfolio goals)

Fig. 48

Source: Database of State Incentives for Renewables & Efficiency (DSIRE)

State Gasoline Tax, 2012

Colorado ranks 33rd in the nation; well below the national average



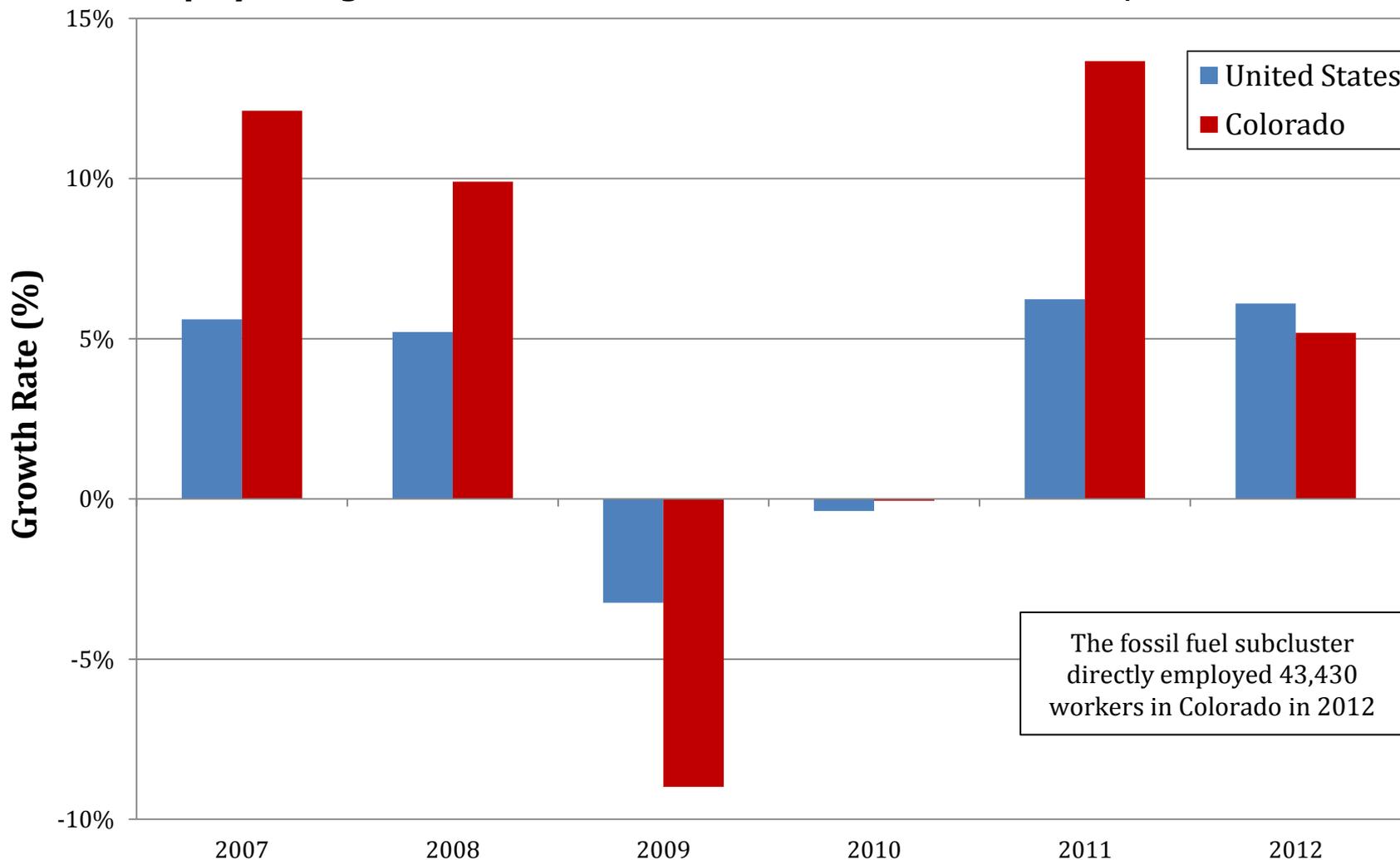
Source: American Petroleum Institute
Note: Top 10 states plus Colorado

Employment & Industry



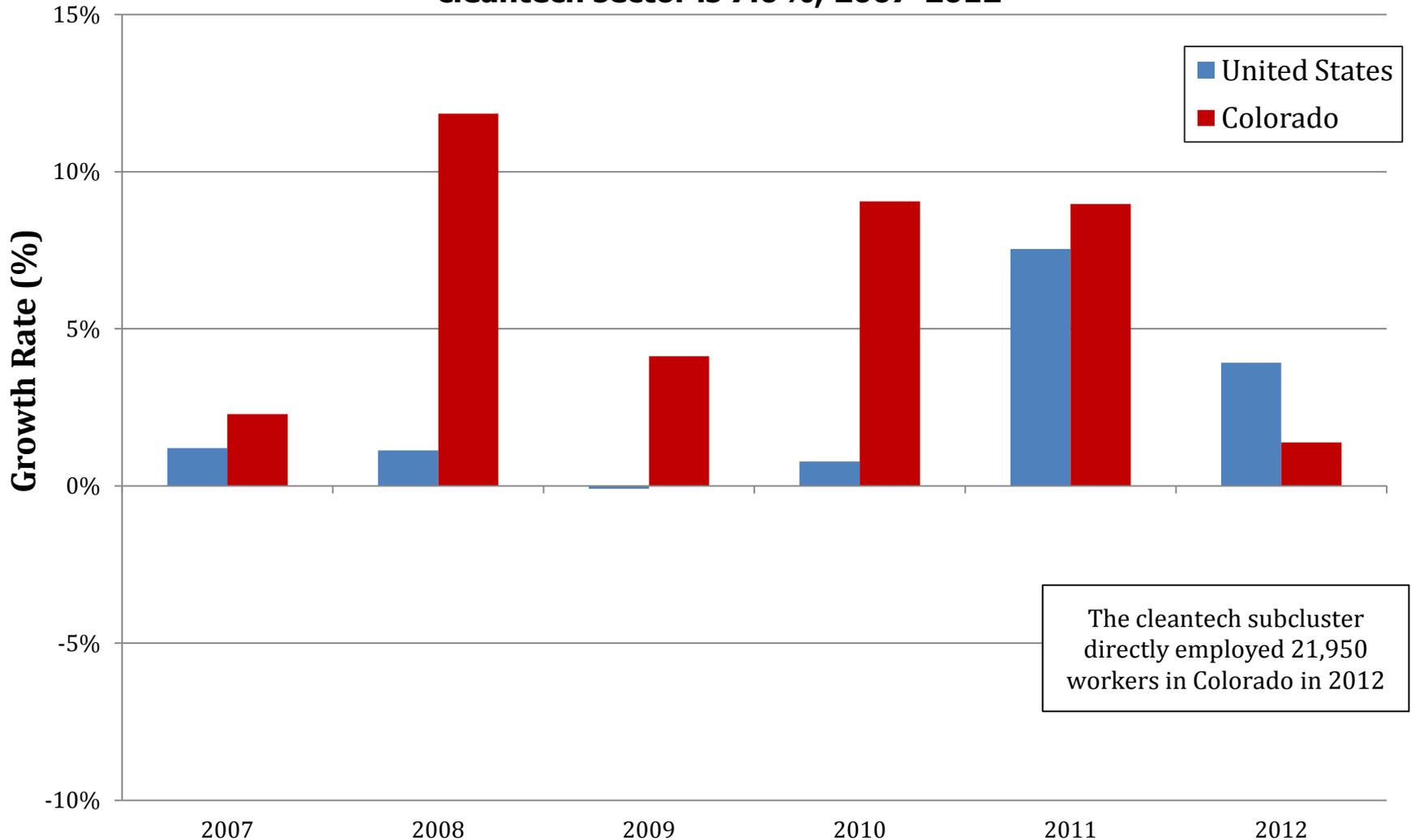
Fossil Fuel - Number of Employees Growth Rate

Brief downturn during economic recession; average annual direct employment growth rate for Colorado fossil fuel sector is 3.6%, 2007-2012



Cleantech - Number of Employees Growth Rate

Recession had minimal impact on Colorado cleantech employment growth; average annual direct employment growth rate for Colorado cleantech sector is 7.0%, 2007-2012



Source: Dun & Bradstreet, Inc.; Marketplace database, July-September, 2006-2010; Market Analysis Profile, 2011-2012

Energy Cluster Economic Impact

65,400 direct energy jobs

Supports an additional 212,000 indirect jobs

Total economic impact of Colorado's energy cluster = \$13.7 billion annually



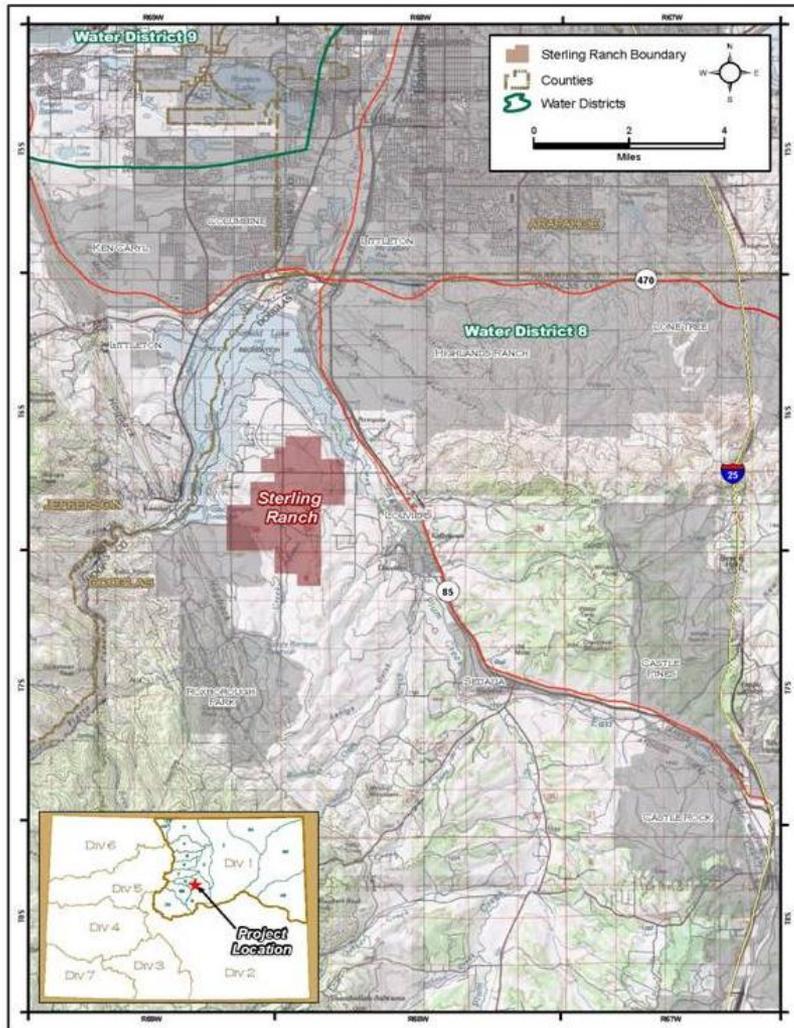
STERLING RANCH RAINWATER HARVESTING AND DEMAND MANAGEMENT



Sterling Ranch
Briefing to
Joint Ag
Committee

3/20/2013

STERLING RANCH – WHO WE ARE



- 21st Century Sustainable Community
- Energy, water, lifestyle
- Recreation & open spaces
- Wildlife corridors
- Low impact development - 37% open space
- Community supported agriculture
- **Leading water sustainability**
 - Demand reduction incorporated into land plan
 - Rainwater harvesting
 - Storm water management
 - Water quality improvement

COLORADO WATER CHALLENGE



- 57% gap in 2050 municipal & industrial water supply for metro basin (SWSI 2010), or about 60,000 to 90,000 acre-feet/year.
- As the State concluded, the gap can be reduced. New growth has an opportunity to develop in new ways to reduce the gap.
- Sterling Ranch PD Water Plan - *commercial implementation of innovative water practices*:
 - Water demand reduction integrated into land plan with look-back adjustments.
 - Homes will use 1/3 of what Douglas County historically required.
 - Regional water supply solutions with conjunctive use.
 - State's 1st Rainwater Harvesting Pilot (not included in water plan until proven).

DEMAND MANAGEMENT VERSUS CONSERVATION

“Conservation”

- Retroactive
- May not be permanent (e.g. watering restrictions)
- Affects budgets and may require higher rates

Demand Reduction

- Essential for new projects
- Prospective for new systems and projects
- Produces permanent water savings
- Built into financing

RAINWATER HARVESTING

- Capturing natural precipitation – rain, snow, hail – and putting to beneficial use on the land it historically fell on.
- Must be done in a manner that does not injure existing water rights.
- Used effectively in many other states.
- Was used in Colorado for centuries.
- Should improve stream water quality by retaining nutrients and pollutants and keeping them out of the streams.
- Should result in lower water and stormwater costs to homeowners.
- Local application of rainwater saves significant water and energy costs compared to other renewable options in South Metro area.

STERLING RANCH TECHNOLOGY DEMONSTRATION CENTER

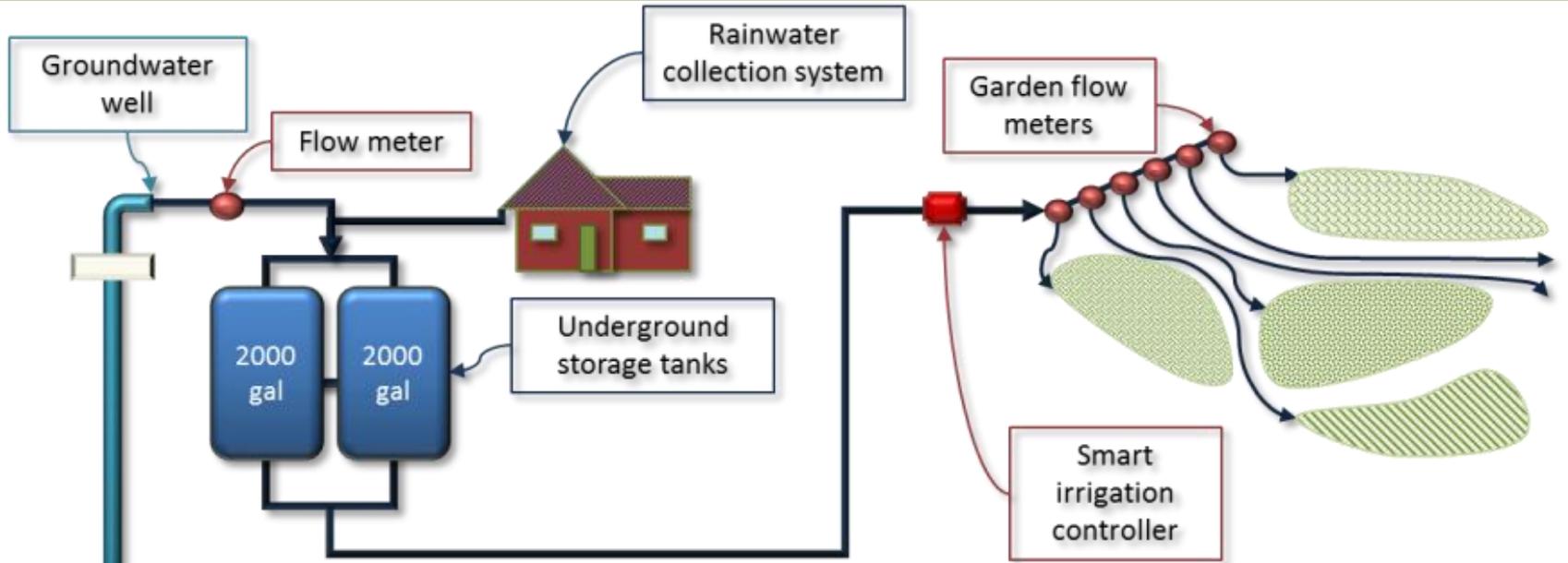
- Rainwater harvesting
- Waterwise landscaping & edible gardens designed by DBG
- Irrigation technology



PRELIMINARY FINDINGS

- **Water Demand Management when incorporated into Land Planning Dramatically Reduces Consumption at the Home**
 - 50% or more reduction over traditional lawn
 - Has a Colorado aesthetic that is pleasing to home builders and buyers
 - Can reduce the homeowner's cost of water even if water prices are high
- **Rainwater Harvesting**
 - A materially important water source when used with water demand management
 - Reliable water source relative to other renewable water supplies
 - Produces significant water even during drought conditions
 - Improves water quality
 - Is very cost efficient when used with stormwater management

TECHNOLOGY SITE LAYOUT



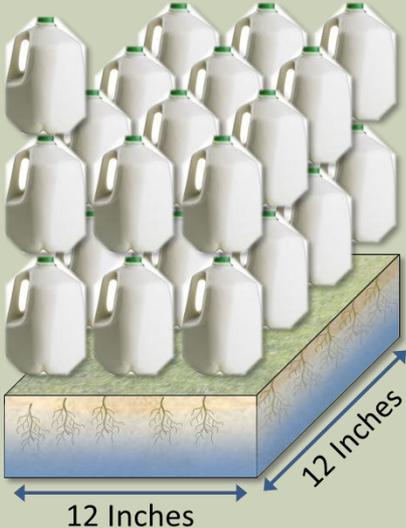
*exempt well permit
allows for rainwater
harvesting*

**Sterling Ranch
weather
station**

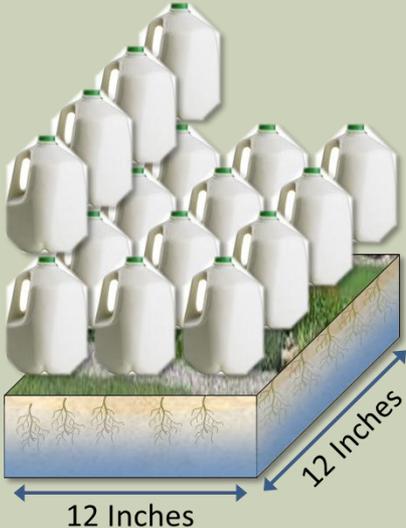


DEMAND MANAGEMENT EXAMPLES

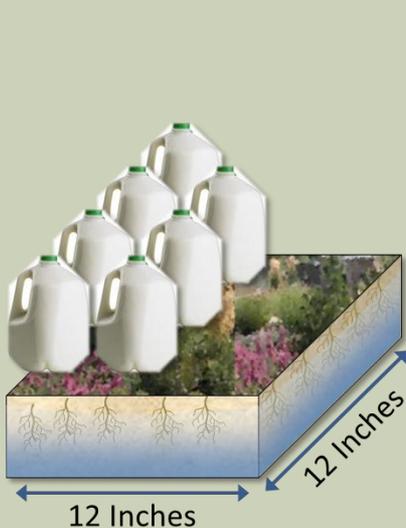
**Traditional,
25 gallons**



**Moderate Conservation,
16 gallons**



**Waterwise,
7 gallons**



2012 DEMO SITE RESULTS

- Record heat, temps 2-4 °F above avg.
- Summer precip 40% below avg.
- Landscape stressed, came back by end of season; plants and shrubs handled prolonged heat better than irrigated turf.
- Overall water use ~12.5 gal/ft²
 - ~30% less than Sterling Ranch Water Plan value, and
 - >50% less than usage for a typical landscape.
- Another year of data with 2013.



2012 RAINWATER CAPTURE

- ~9,600 gallons captured during 2012 water year (Nov to Oct, 14.9 inches).
 - 85% of average annual precipitation.
 - Volume = ~1/3rd demand of 1,500 sq-ft of irrigated area of a typical Sterling Ranch waterwise home.
- ~1/3rd of volume captured during the non-irrigation season.
- Cisterns filled and spilled in the spring.
- Hail storms may be a challenge with cistern capture.
- No problems with quality of captured water.



BEYOND INDIVIDUAL CISTERNS

- Regional systems make rainwater harvesting economically viable.
- Can be integrated into an enhanced storm drainage system:
 - Increase long-term storage capacity
 - Pond liners to reduce seepage losses
 - Reduce nutrient stream loading
- Targeted regional precipitation collection system could have captured ~480 acre-feet in 2012
 - About 1/4 of the annual outdoor demand at build-out.
- Current models show regional collection could save thousands of dollars per ac-ft over potable supply for irrigation. More data to refine.



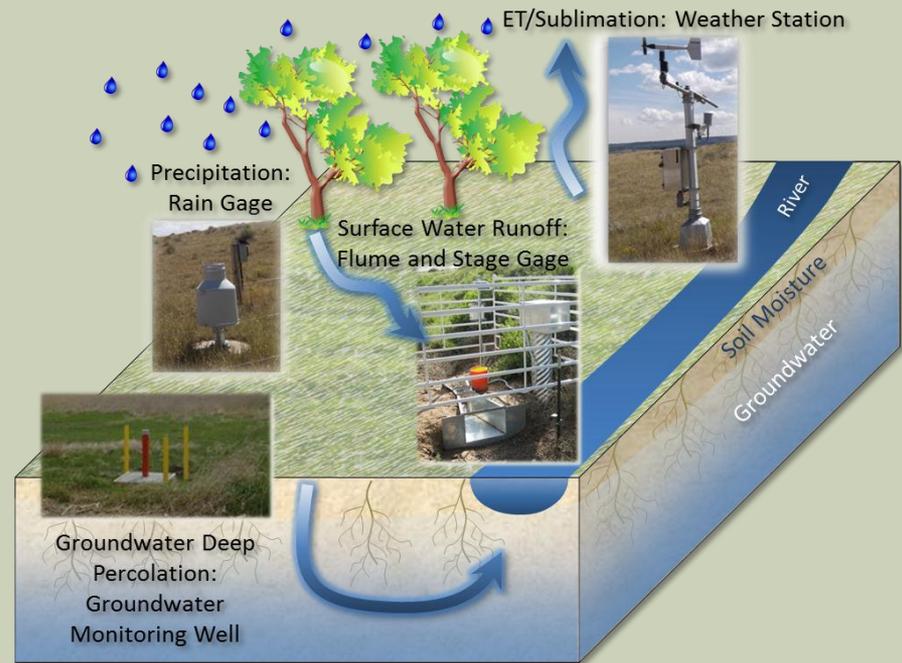
Underground Storage in Denver Metro Area source: Precast Concepts



Alternative to Cisterns – Regional Collection

PROGRESS TOWARD OBTAINING A WATER RIGHT

- Quantifying pre-development return flows from precipitation to create a plan that protects existing water rights:
 - Weather station (ET and precipitation) installed March 2010;
 - Surface water runoff monitoring started in June 2011;
 - Groundwater monitoring wells installed September 2011.
- Data will support a water court application for an augmentation plan.



RUNOFF UNDER NATURAL CONDITIONS

- Surface water monitoring station on Upper Sterling Gulch.
- Additional trail cameras to document real-time runoff from site at Titan Road.
- No runoff from site at Titan Road in 2011 or 2012.



NEXT STEPS

- Develop and analyze rainwater harvesting data under the existing law and prepare for an augmentation plan.
- One more year of data from the technology demonstration site on both rainwater and demand management.
- More research into the impact of rainwater harvesting on stream water quality.
- Study the operational integration of rainwater harvesting into stormwater management.
- Planning full scale development using both Demand Management and Rainwater Harvesting at Sterling Ranch.

DISCUSSION

