THE GEORGE WASHINGTON UNIVERSITY LAW SCHOOL

The Changing Landscape for Electric Energy generation

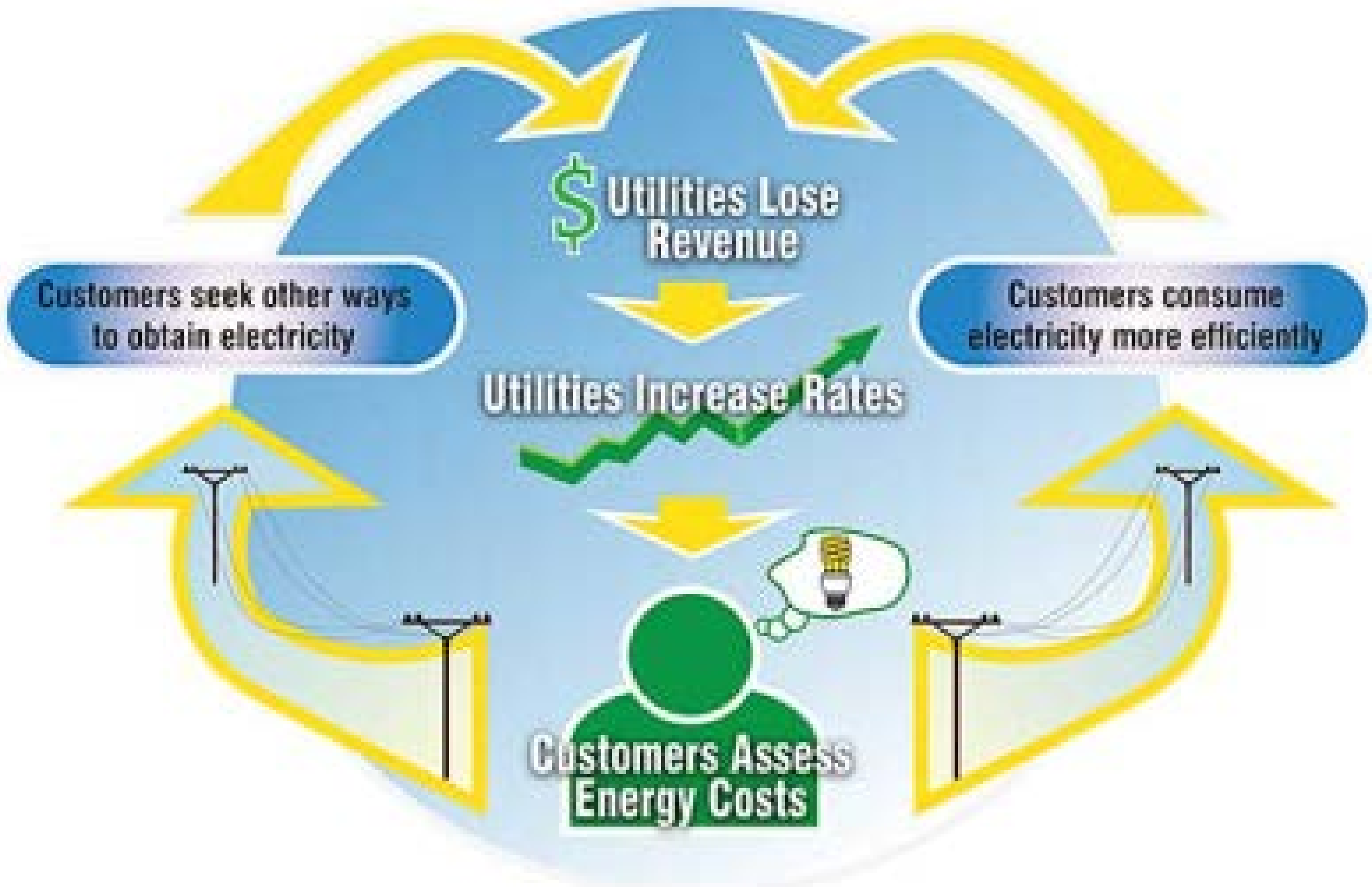
Tipping Points

- SO2 and NOx cap and trade program
- 2001 ELI study of actual impact on electric utilities
- One conclusion: these regulations by themselves were not sufficient to drive coal plant closure or fuel switching
- Probably would require carbon regulation to tip the scales away from coal

A New World

- I feel the earth move under my feet
- I feel the sky come tumbling down
- I just lose control
- Down to my very soul

Disruptive Change

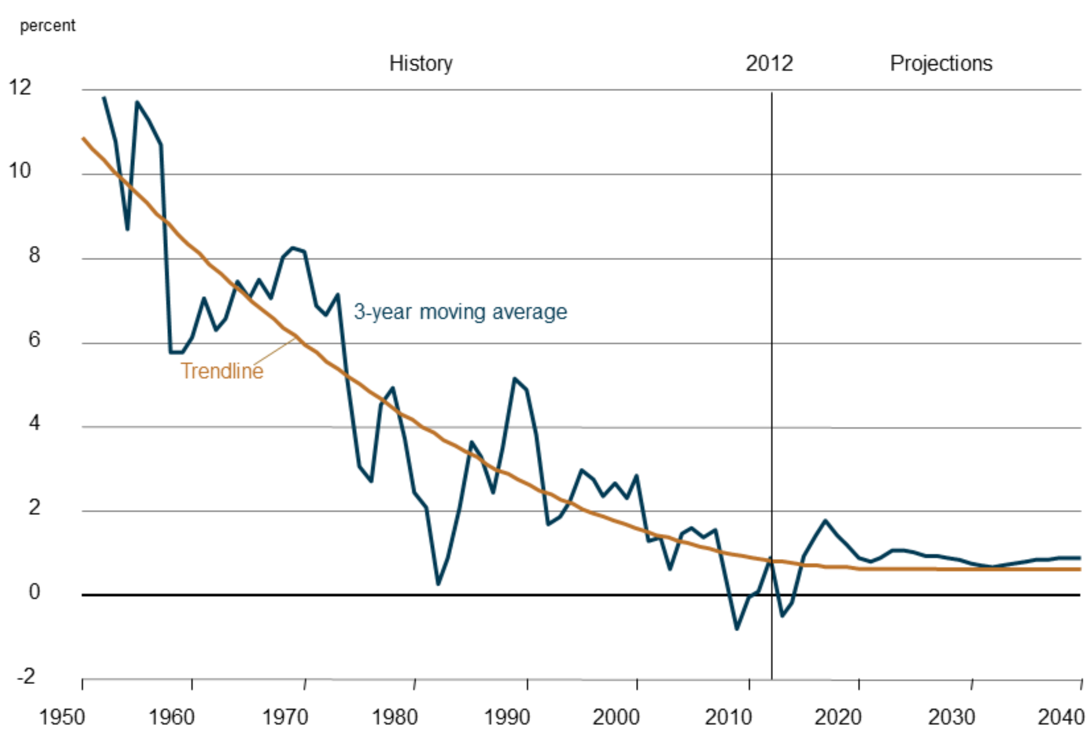


The Future of Coal

- Cheaper and more predictable gas supplies
- Sierra Club Beyond Coal campaign

Electricity Sales

Figure MT-29. U.S. electricity demand growth in the Reference case, 1950-2040



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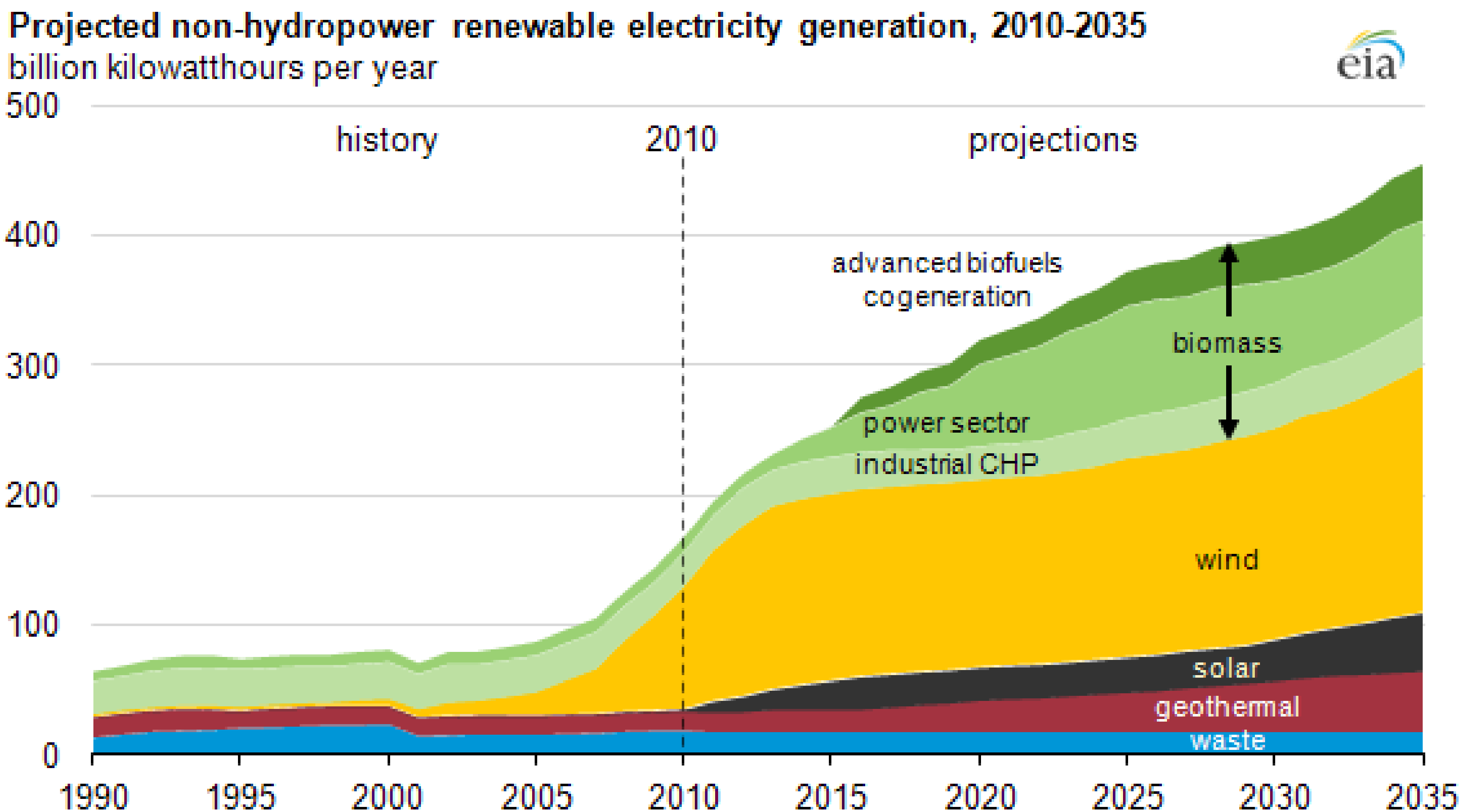
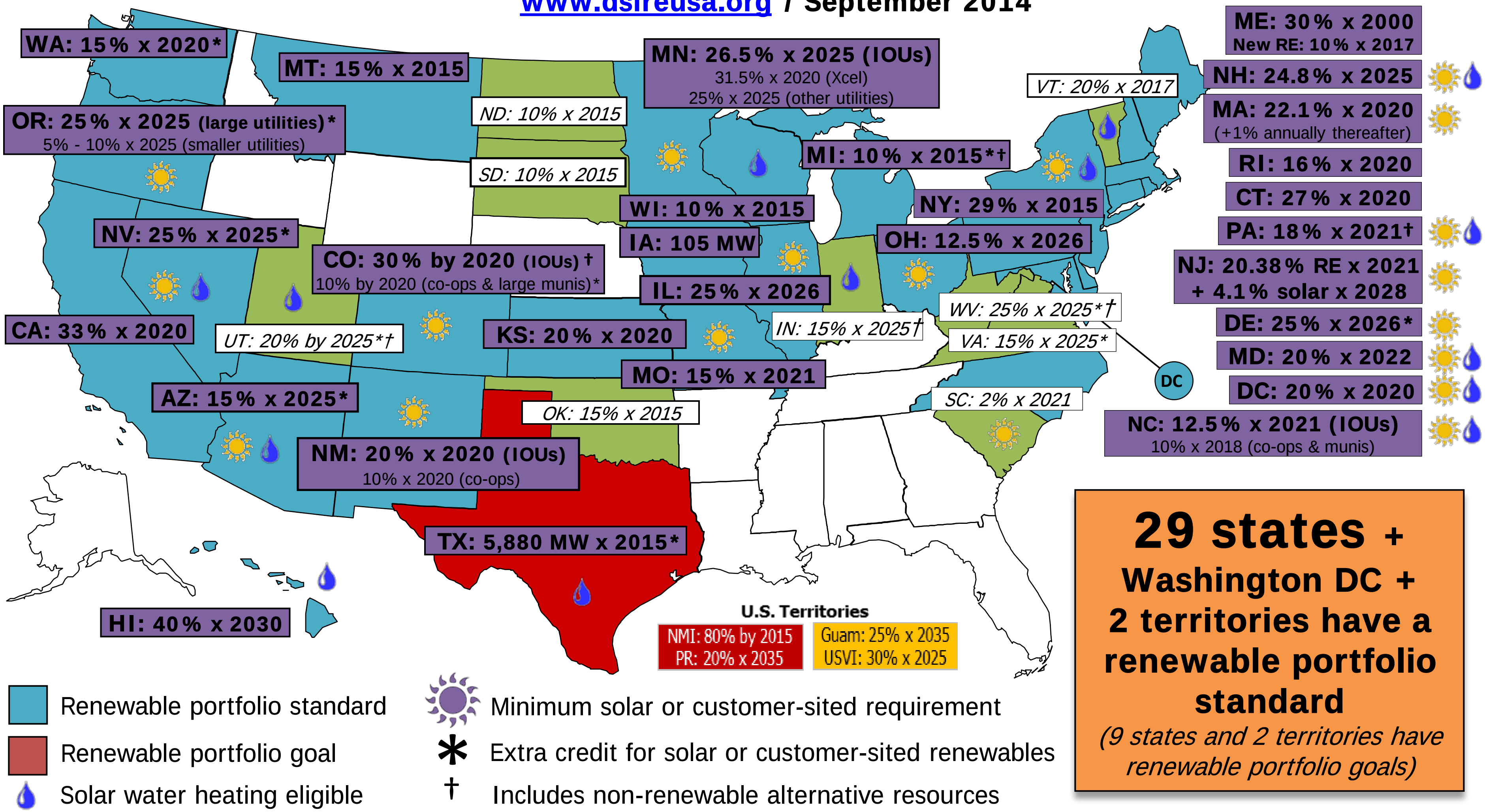
Cost Competitive Alternatives



Renewable Portfolio Standard Policies

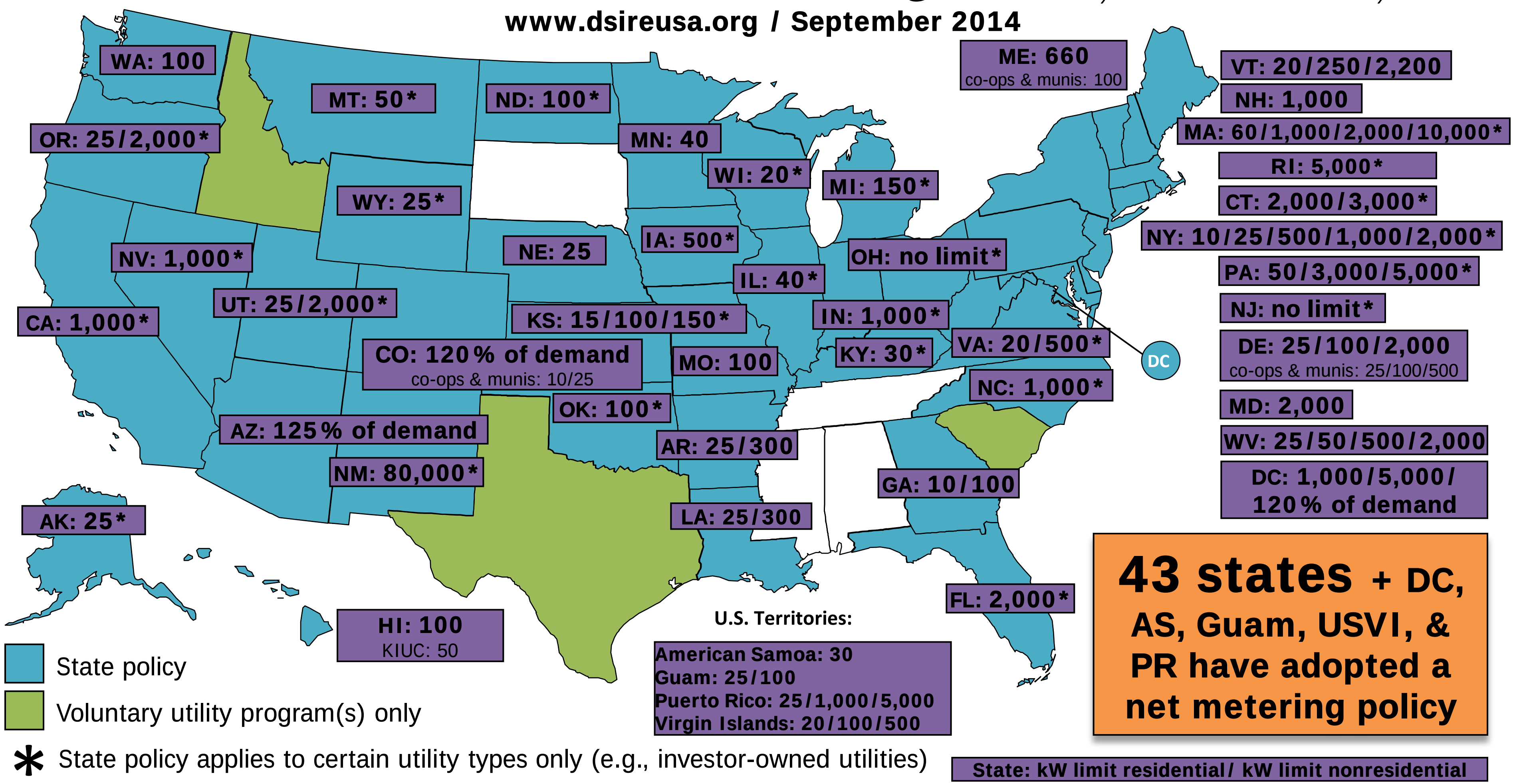
www.dsireusa.org / September 2014



Net Metering

www.dsireusa.org / September 2014

Note: Net Metering rules are being actively discussed in over a dozen state public service & utility commissions across the country.



Note: Numbers indicate individual system capacity limit in kW. Some limits vary by customer type, technology and/or application. Other limits might also apply. This map generally does not address statutory changes until administrative rules have been adopted to implement such changes.

Tax Incentives

- PTC
- State Incentives

Aging Plants

43% without flue gas desulfurization

Years Built	# of Units	Total Capacity (MW)
2005-2009	21	6,785
2000-2004	13	1,382
1995-1999	24	4,372
1990-1994	67	8,638
1985-1989	102	23,734
1980-1984	117	56,105
1975-1979	125	55,879
1970-1974	137	66,466
1965-1969	158	41,656
1960-1964	157	25,310
1955-1959	209	28,883
1950-1954	213	17,518
1940-1949	93	2,583

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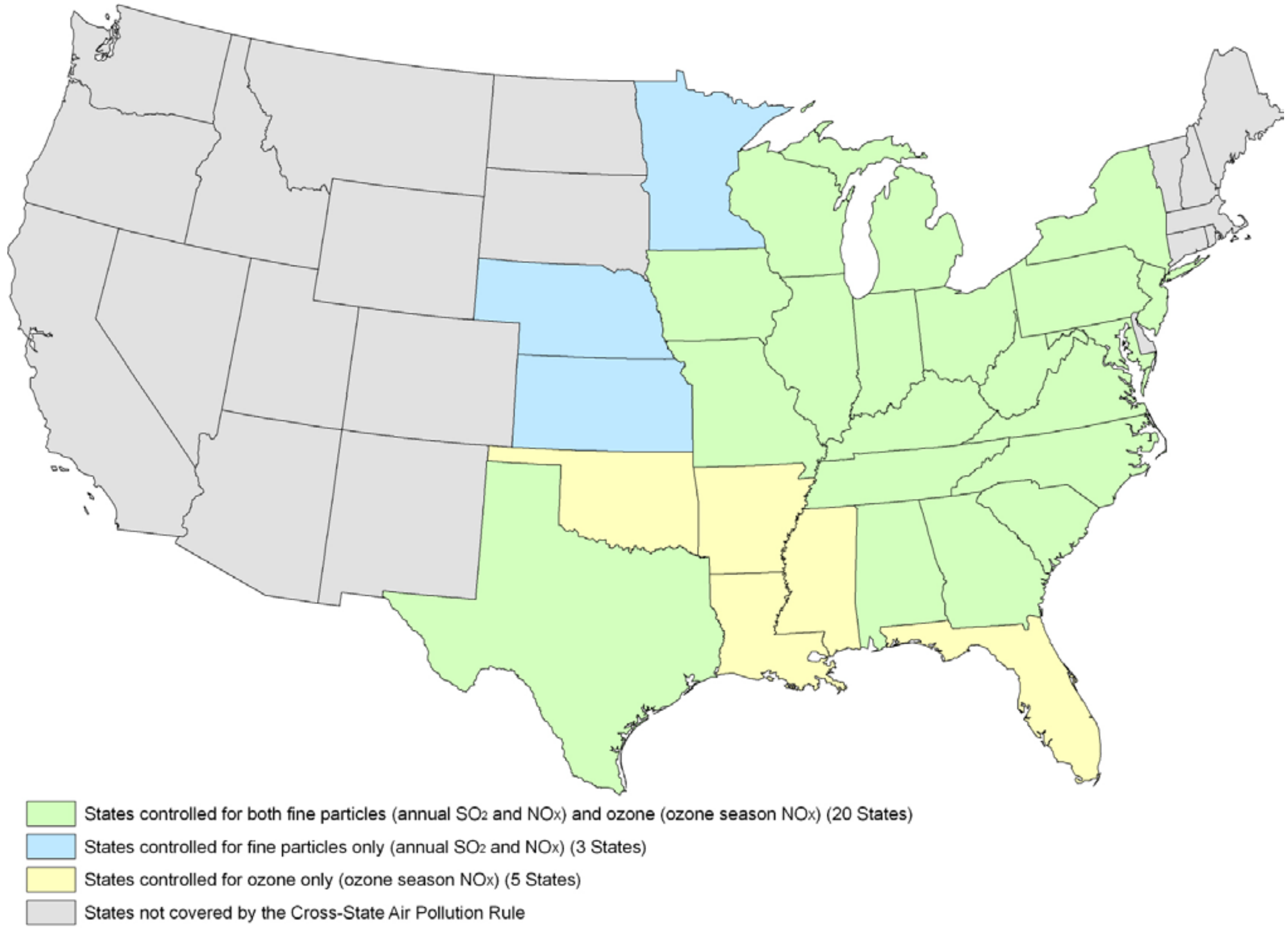
Environmental Rules

- Cross State Rule
- SO2 and NOx
- 28 states
- $2.4 billion per year



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Rules

- Power Plant Air Toxics Rule
- Primary focus is mercury
- Power plants the largest source
- $9.2 billion per year

Rules

- Clean Power Plan
- 25% reduction in CO_2 emissions by 2030 from a 2005 baseline
- $7.3-$8.8 billion per year

Retirements

- 1988—coal 57% of U.S. electric generation
- 2013—coal 37.4%
- 2017—coal < 33%

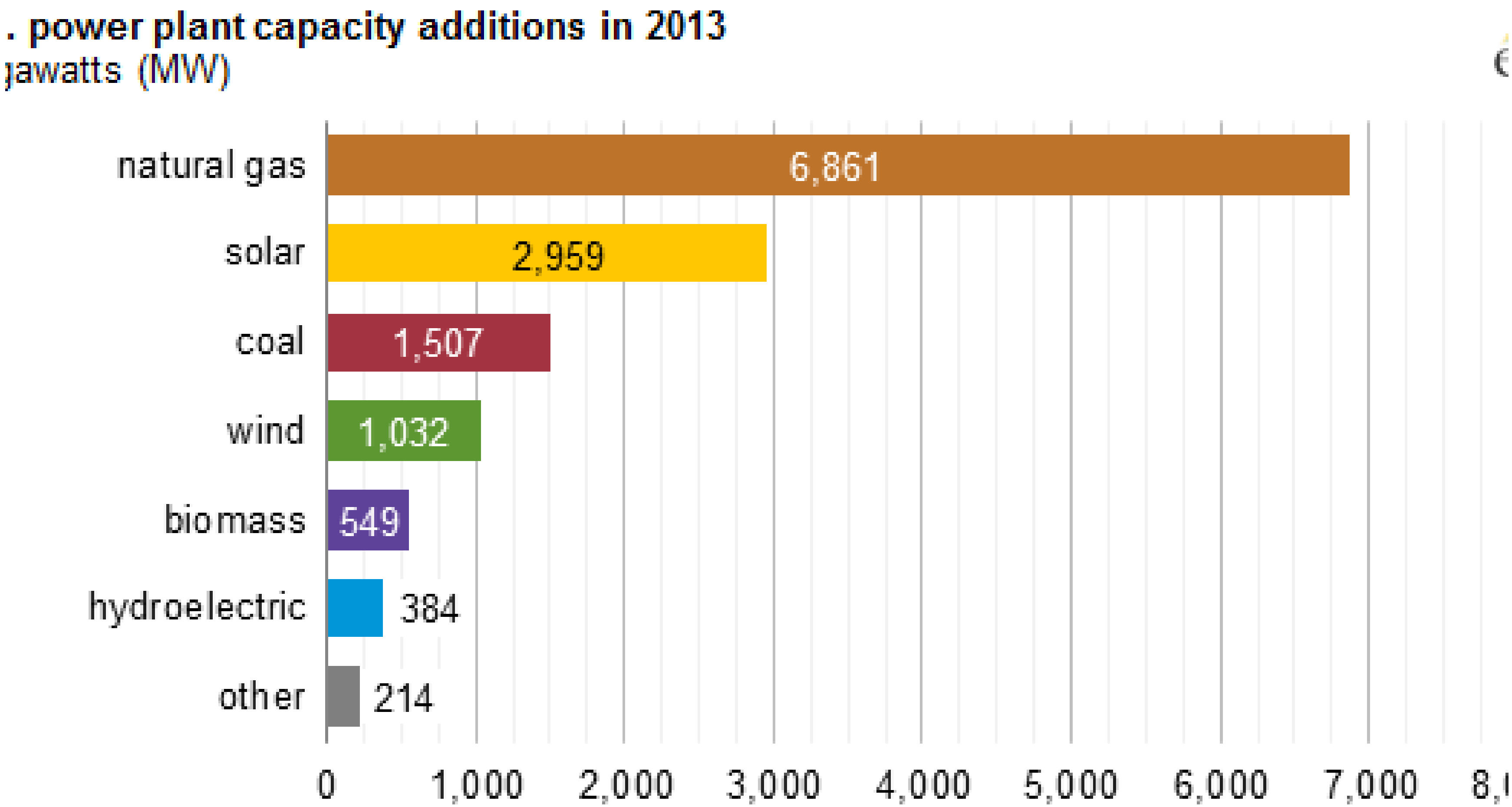
Coal in electric generation

- 1988—coal 57% of U.S. electric generation
- 2013—coal 37.4%
- 2017—coal < 33%
- As of 2011 589 coal-fired power plants in the U.S. down from 633 coal-fired power plants in 2002.
- EIA—49 GW retirements or about 17% of all coal but only 5% of total electric generation

Retirements

- EIA—49 GW retirements or about 17% of all coal but only 5% of total electric generation
- EPA Clean Power Plan—20% of coal will close by 2020 (about 48 GW)
- Industry estimate Clean Power Plan—as much as 72 GW

Next Generation



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Where now

- XL Energy 2015 Resource Plan
- Historically a coal and nuclear utility
- More diversifies
- Different relationship to stakeholders

Context

- 40 percent CO2 reduction by 2030
- 1.5% per year energy efficiency mandate
- Perhaps 40% RPS
- 60% non-carbon generation by 2030

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Assumptions

- Customers want more choice in their energy services and products,
- Advancements in renewable generation technologies,
- The expanding role of distributed generation and the distribution system, and
- The inevitable rising cost of providing service

2020

- 100 megawatt solar peaking plant
- 187 additional megawatts of solar
- 345 Calpine combined cycle gas
- 232 megawatt coal to gas repower
- 300 megawatt community solar gardens and small scale solar

Repowering Results

- **Sulfur Dioxide** 39,000 tons/yr 93% reduction
- **Nitrogen Oxide** 34,000 tons/yr 91%reduction
- **Mercury** 199 pounds/yr 81% reduction
- **Particulates** 730 tons/yr 55% reduction
- **Carbon Dioxide** 1.8 m tons/yr 21% reduction

2030

- Wind—Add 1,800 MW
- Solar—Add 1,700 MW of utility scale
- Natural gas—Add 1,750 MW of gas peaking
- Operate nuclear through 2030
- Operate large coal through 2030 at reduced levels

A new world

- Come Senators and Congressmen
- Please heed the call
- Don’t stand at the doorway
- Don’t block the hall

- For he that gets hurt
- Will be he who has stalled
- There’s a battle outside
- And it’s ragin’

- It’ll soon shake your windows
- And rattle your walls
- For the times are a changin’