



The State of Energy Transition in the U.S.

Chris Nelder | October 11, 2016

- Colorado Renewable Energy Society - Boulder County Chapter



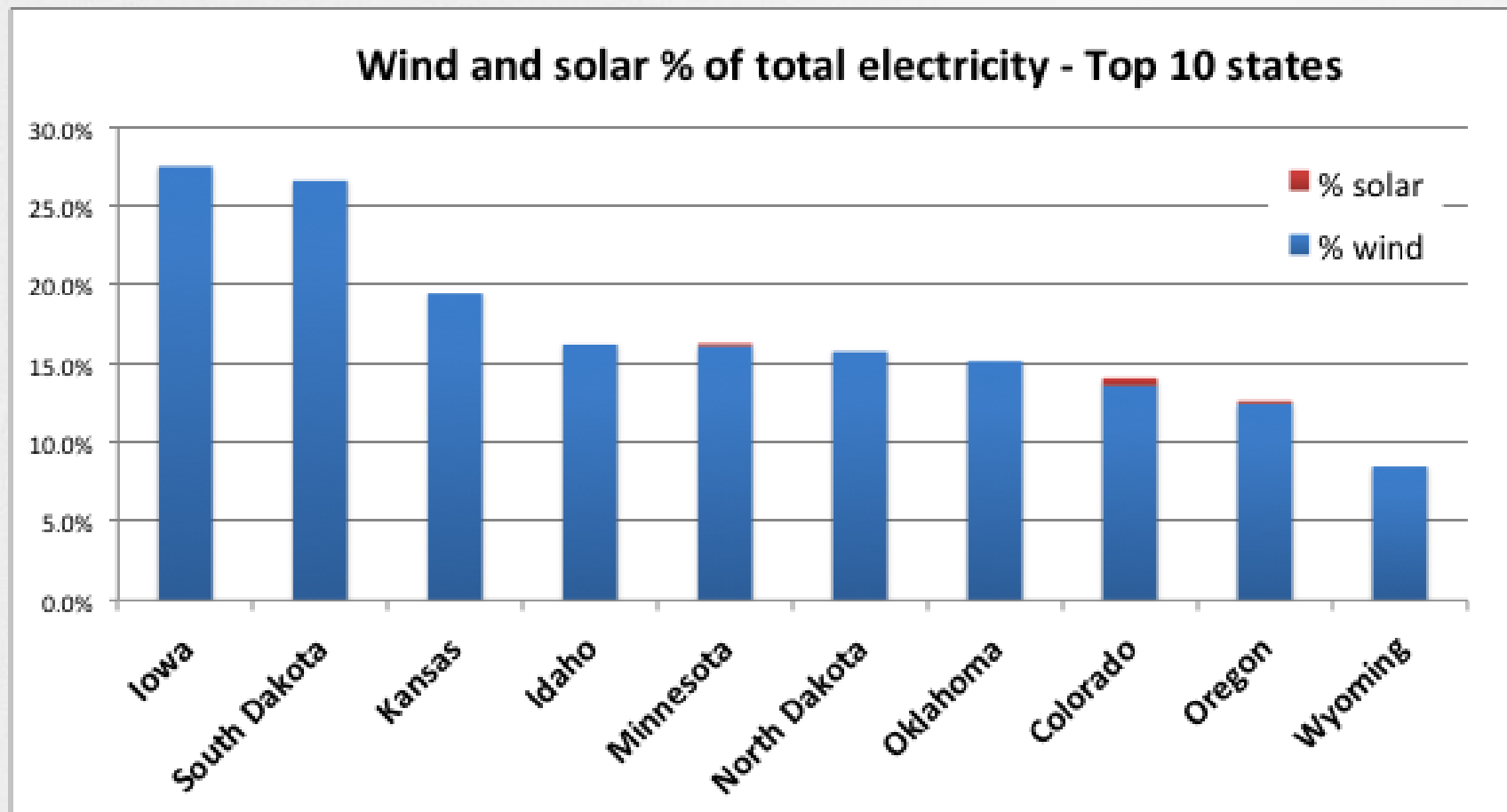
Who am I?

- Electricity Manager with Rocky Mountain Institute
www.rmi.org
- Host of the Energy Transition Show podcast
www.energytransitionshow.com

Fuels: Renewables have hit the big time

- In 1999, **no states** had a renewable energy (solar in their top 3 fuels for electricity generation).
- In 2015, **22 states** had at least one in the top three.
- Hawaii was the first to have solar in its top 3. Iowa was the first to have wind in its top 3.

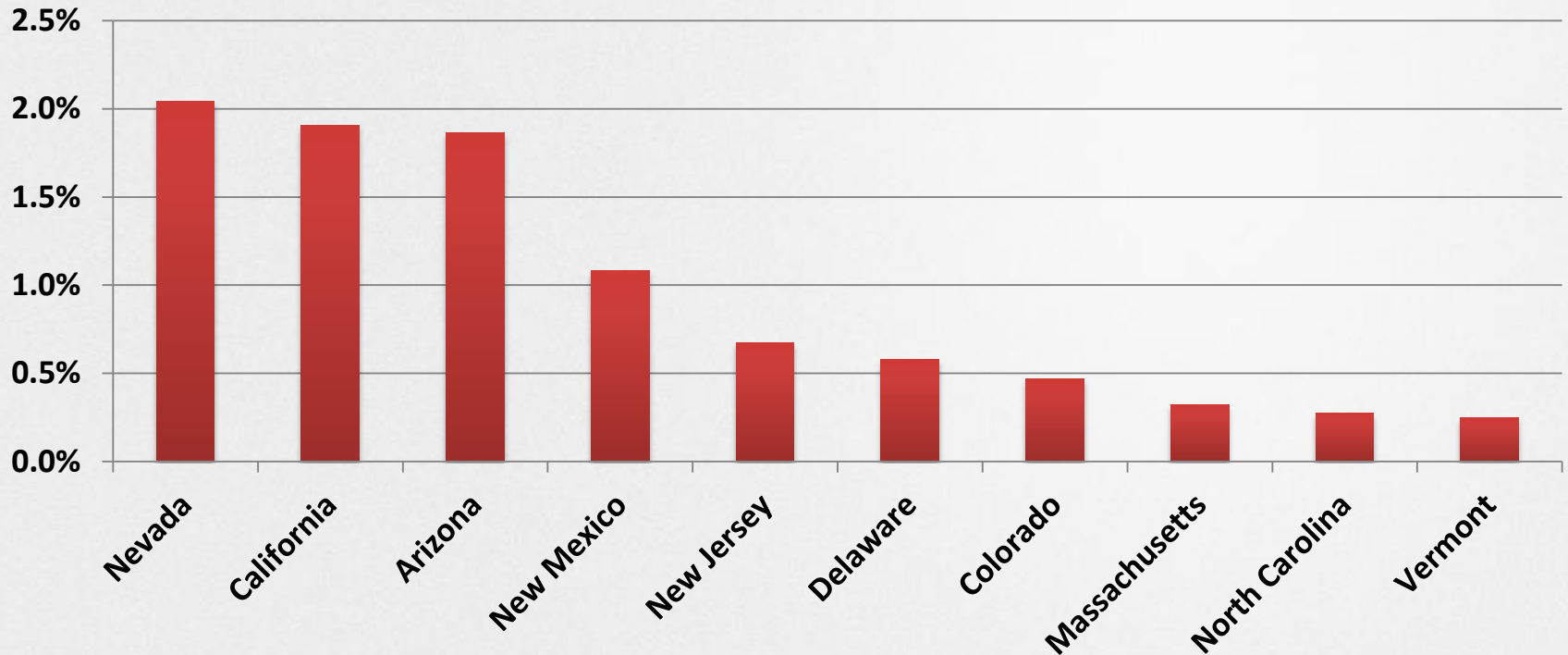
But it's mostly wind on a % basis...



EIA 2013 data

Top 10 solar states

Solar % of total electricity - Top 10 states



EIA 2013 data

Grid Power: Grid parity is arriving

- Low-cost solar in US:
 - \$37/MWh (3.7 cents/kWh) in Palo Alto
 - \$38/MWh (3.8 cents/kWh) in Nevada
- Low-cost wind in US:
 - \$21/MWh (2.1 cents/kWh) in the Southwest Power Pool
 - \$24/MWh (2.4 cents/kWh) in ERCOT
 - \$240/MWh (24.4 cents/kWh) for Block Island OFFSHORE wind farm – **HALF THE PRICE of its diesel power**

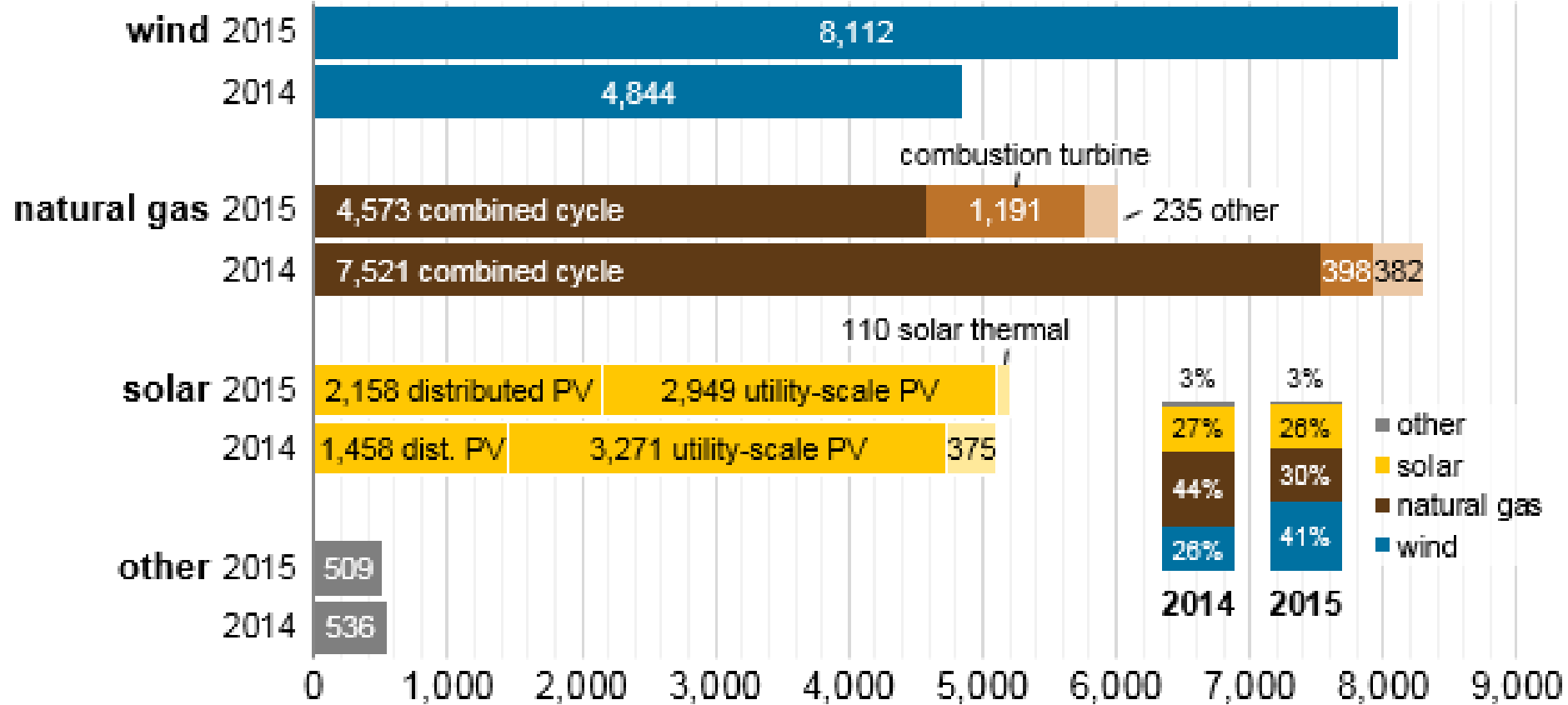
Grid Power: Grid parity is arriving

- Low-cost solar internationally:
 - \$35/MWh (3.5 cents/kWh) in Mexico
 - \$29/MWh (2.9 cents/kWh) in Chile **Half the price of coal**
 - \$29/MWh (2.9 cents/kWh) in Dubai in June
 - \$24/MWh (2.4 cents/kWh) in Abu Dhabi in September
- Low-cost OFFSHORE wind internationally:
 - \$67/MWh (6.7 cents/kWh) in Danish North Sea for
 - \$66/MWh (6.6 cents/kWh) in Netherlands

Grid Power: RE is rapidly gaining market share



U.S. electric generation capacity additions, 2015 vs. 2014
megawatts (MW_{AC})



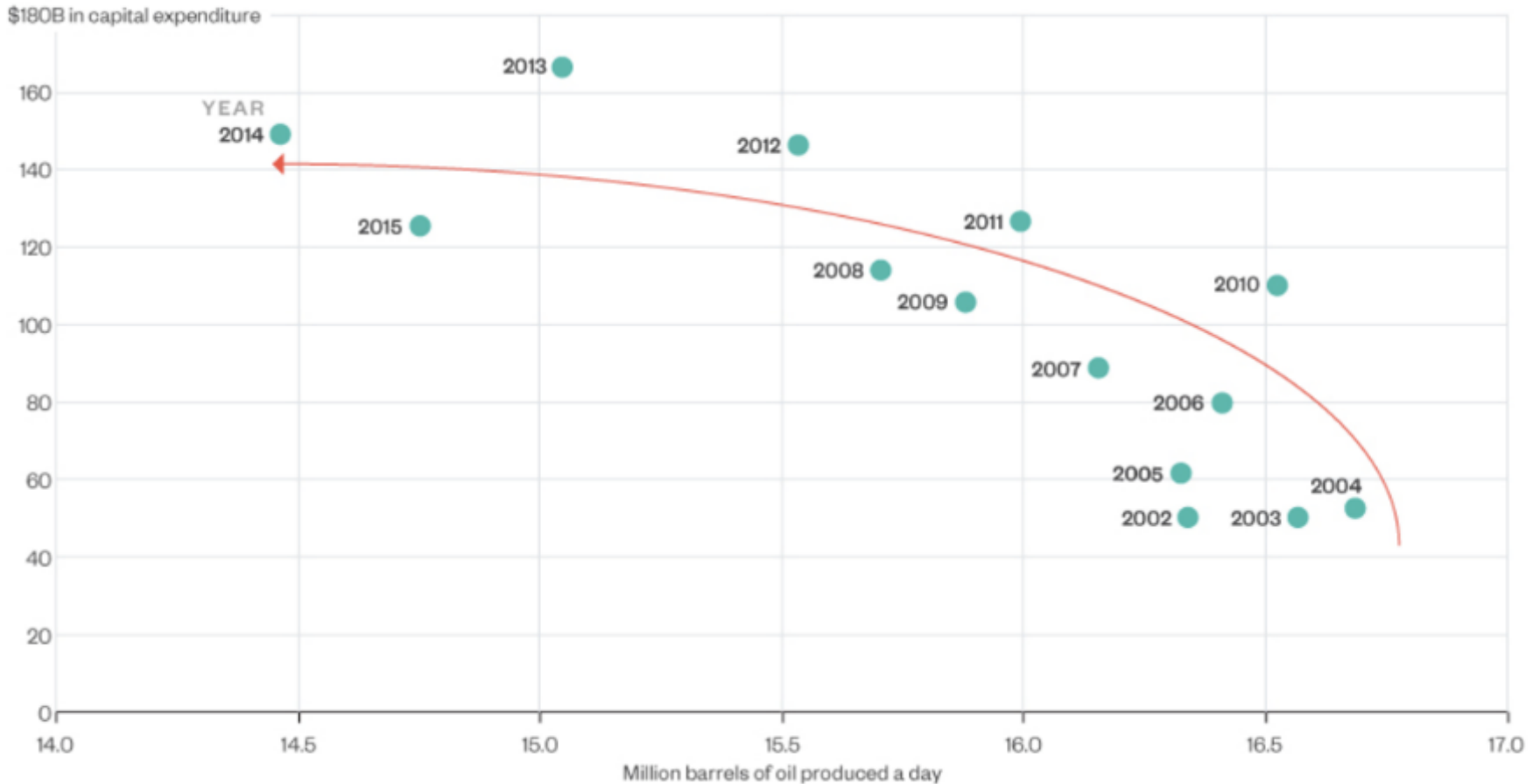
Climate policy also pushing RE

- Despite years of confident forecasts from IEA, EIA and others, CCS still doesn't really exist and isn't likely to exist without roughly half a trillion dollars in public R&D funding
- Nuclear is all but dead in the US and most of Europe; big plants elsewhere starting to founder (e.g., China) or being cancelled (India)
- That leaves renewables – mostly wind and solar – and efficiency, demand response, etc. as the remaining viable options for addressing climate change

Fuels: Poor outlook for oil

Trouble with the Curve

Big Oil's capital expenditure has exploded but production has fallen by 1.6 million barrels a day since 2002

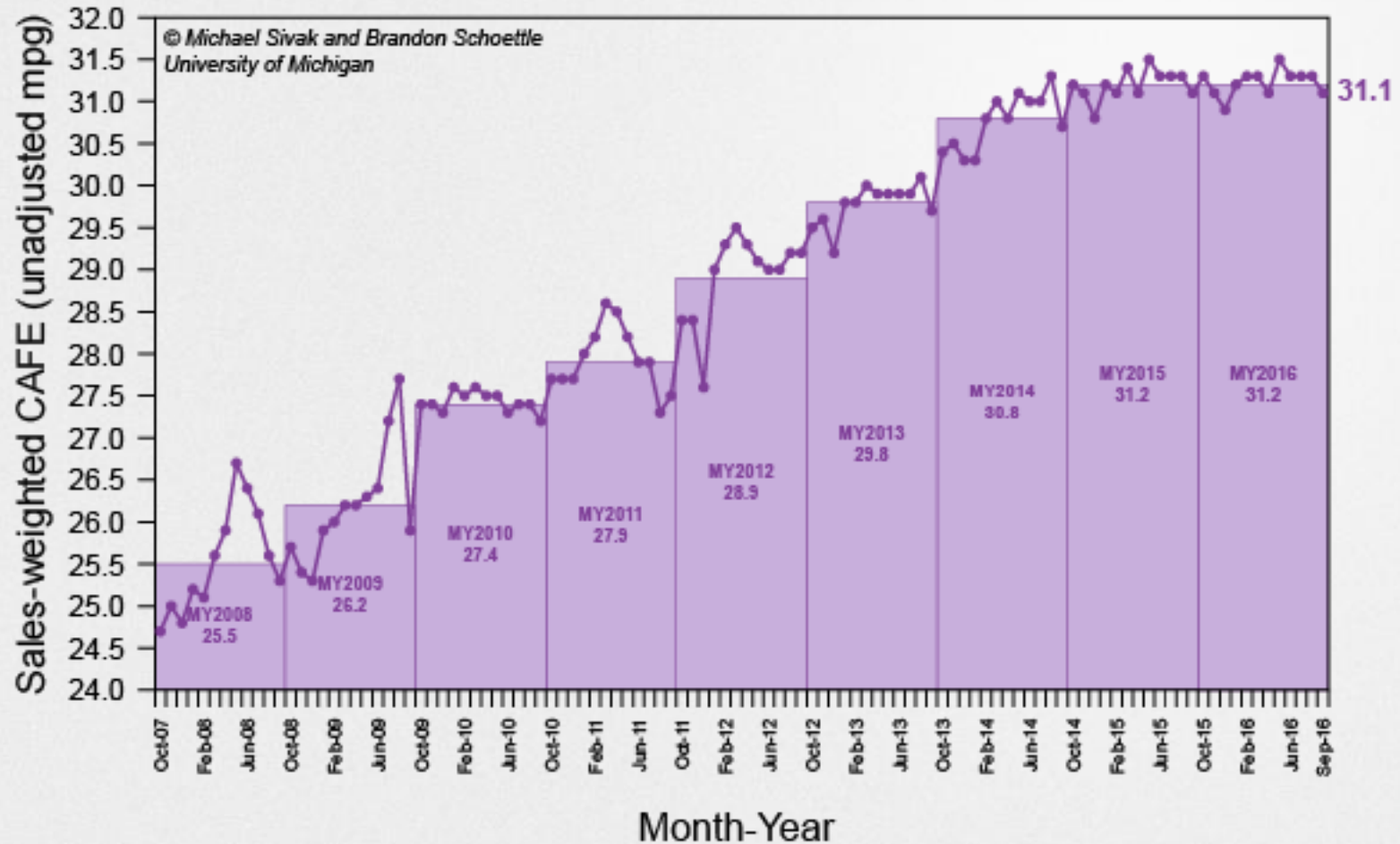


Beyond fuels: Vehicles

- Electric vehicles may be about to hit a growth spurt, albeit from a low level...
- ... but no impact on gasoline demand in the US yet (which just hit an all-time high in August)
- After years of rising CAFE standards, the average fuel economy of existing US fleet of 240 million light vehicles is still just **21.4** mpg
- Sales of SUVs, big vehicles are rising sharply

Beyond fuels: Vehicles

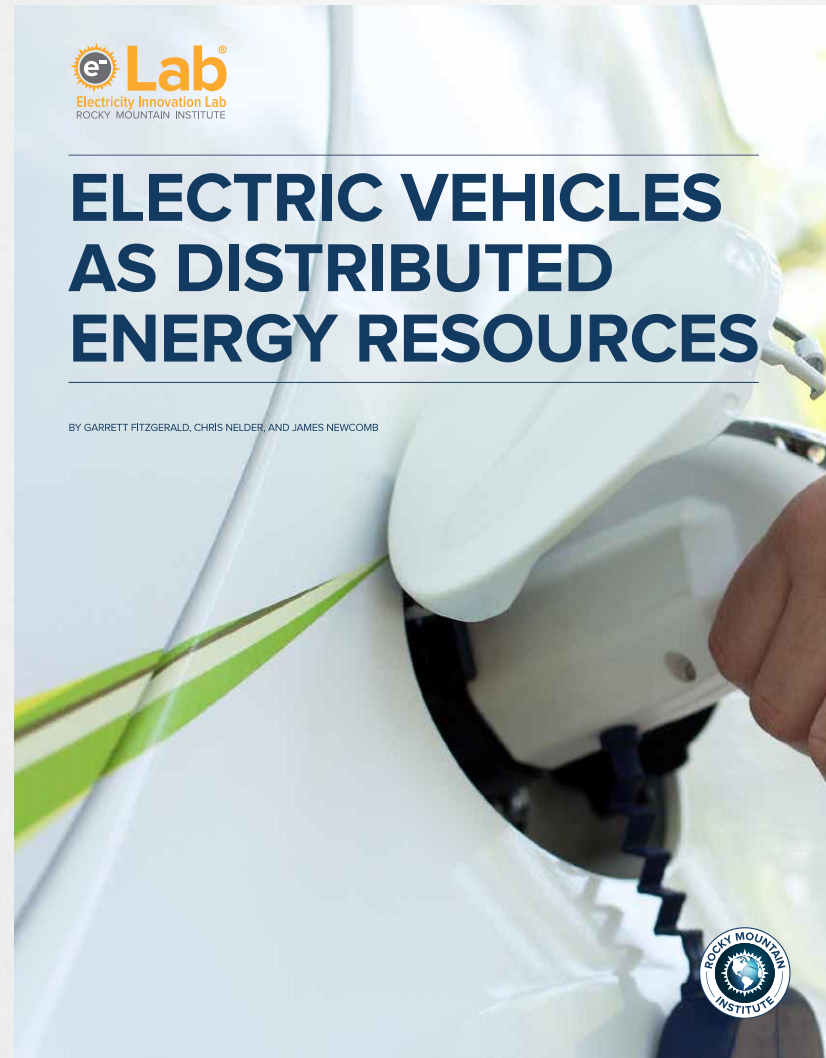
Sales-weighted fuel economy stopped improving when oil prices started crashing in mid-2014



Beyond fuels: Vehicles

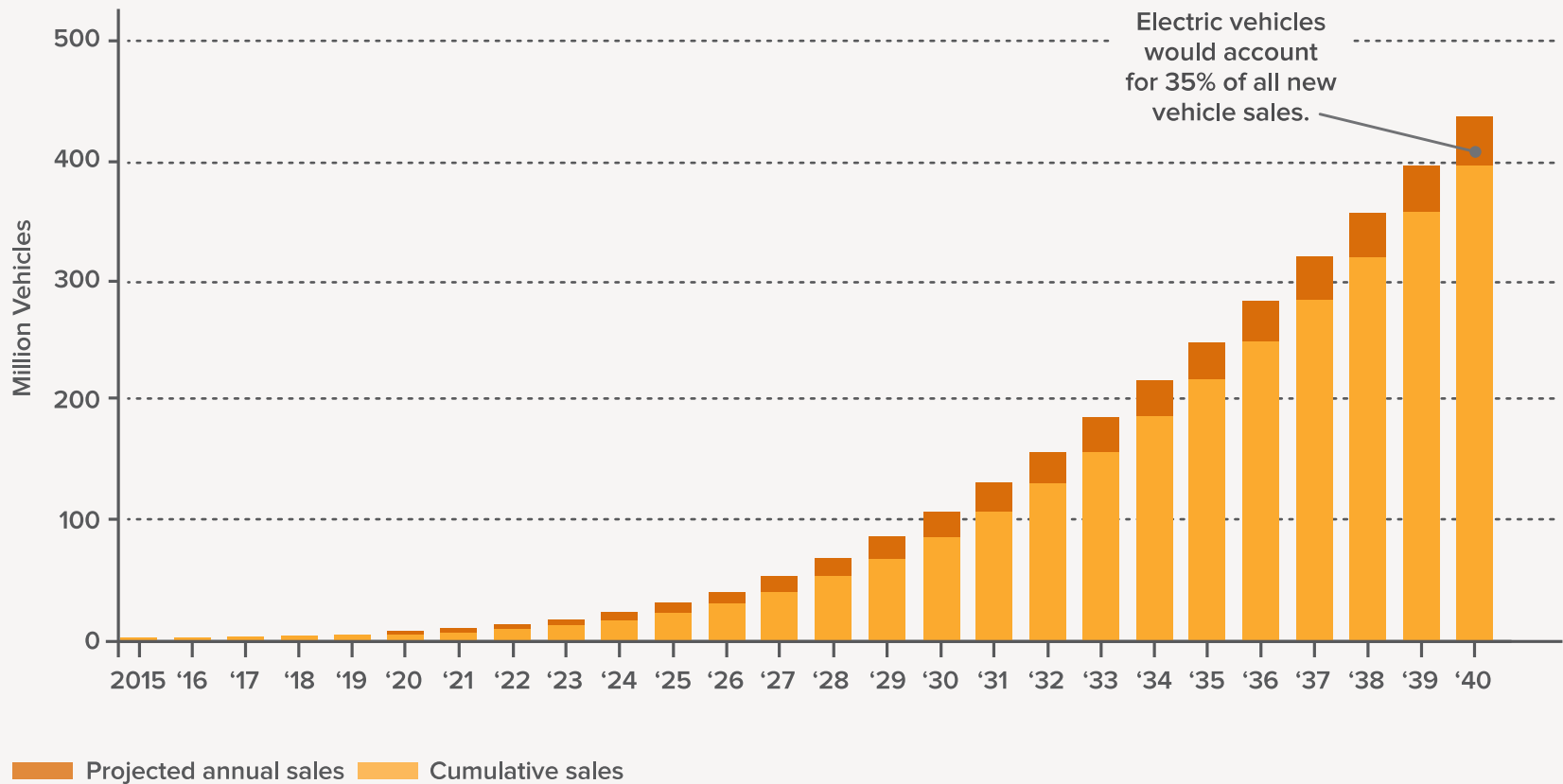
However:

- Significant opportunity for EVs to offer important and valuable grid services, per RMI paper



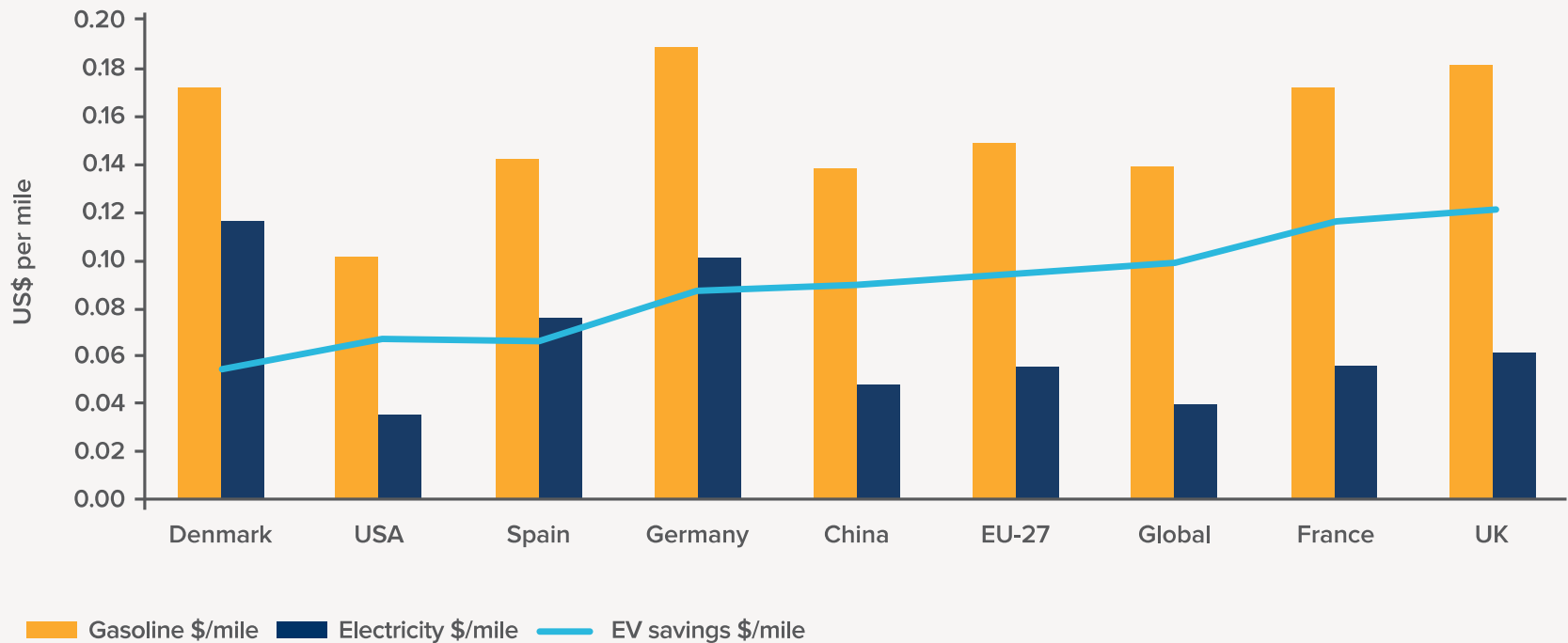
Beyond fuels: Vehicles

However: Bullish sales projections (BNEF)



Beyond fuels: Vehicles

However: Significant savings



Beyond fuels: Grid power

- Efficiency is finally getting some real traction after decades of neglect – hope for new market-based policies in NY (REV), CA (various), and nationally (efficiency.org, Open EE Meter)
- Demand response is becoming recognized as a better solution to demand peaks than generation from expensive new peaker plants
- Utility capex is slowly reorienting away from central assets and toward DERs (CA, NY), saving customers billions of dollars

Beyond fuels: Grid power

- New approaches to rate design (time-varying rates) are creating more opportunity for behind-the-meter assets and DERs, especially demand response. Important for EVs (see SDG&E pilot).
- Performance-based regulation is the new hotness, even in regulated markets
- Dinosaur generation plants (old coal, new and old nuclear) are dying off faster than anyone expected (ref. recent article hyperventilating about that)
- Potential, poorly understood risk of supply shortfall in future

Beyond fuels: Customer-side

- Customers are quickly adopting energy efficiency tech like smart thermostats, smart water heaters, demand response providers controlling AC, “smart home” tech, etc.
- Rooftop solar going strong
- Increased interest in behind-the-meter battery backup thanks to Tesla
- Still need lots of infrastructure (AMI, bi-directional inverters, telemetry, progressive tariffs) but customer-side tech is advancing *totally outside utility planning processes*

The Energy Transition is Unstoppable

- RE sporting lowest costs
- Coal and nuclear unable to compete
- Accelerating customer interest and adoption
- Increasingly progressive regulation
- Paris agreement now binding...

The energy transition has become unstoppable.

This genie cannot be put back into the bottle.



The Energy Transition Show

Geek out with my podcast on energy transition!

www.energytransitionshow.com

