Grid of the Future: Centralized or Distributed?

Dan Seif, Managing Director

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UT ENERGY WEEK 2017

February 8, 2017

4 Step Path

Historical

1

Centralized, large-scale (>0.5 GW), fossil/nuclear/hydro

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4 Step Path

Historical

1

Centralized, large-scale (>0.5 GW), fossil/nuclear/hydro

- All States in US based on Majority Generation.
- All States in US based on Capacity. IA, CA, and HI* very large minority renewable capacity.
- Minority of US based on New Build Capacity. Southeast (not incl. TX) lags.

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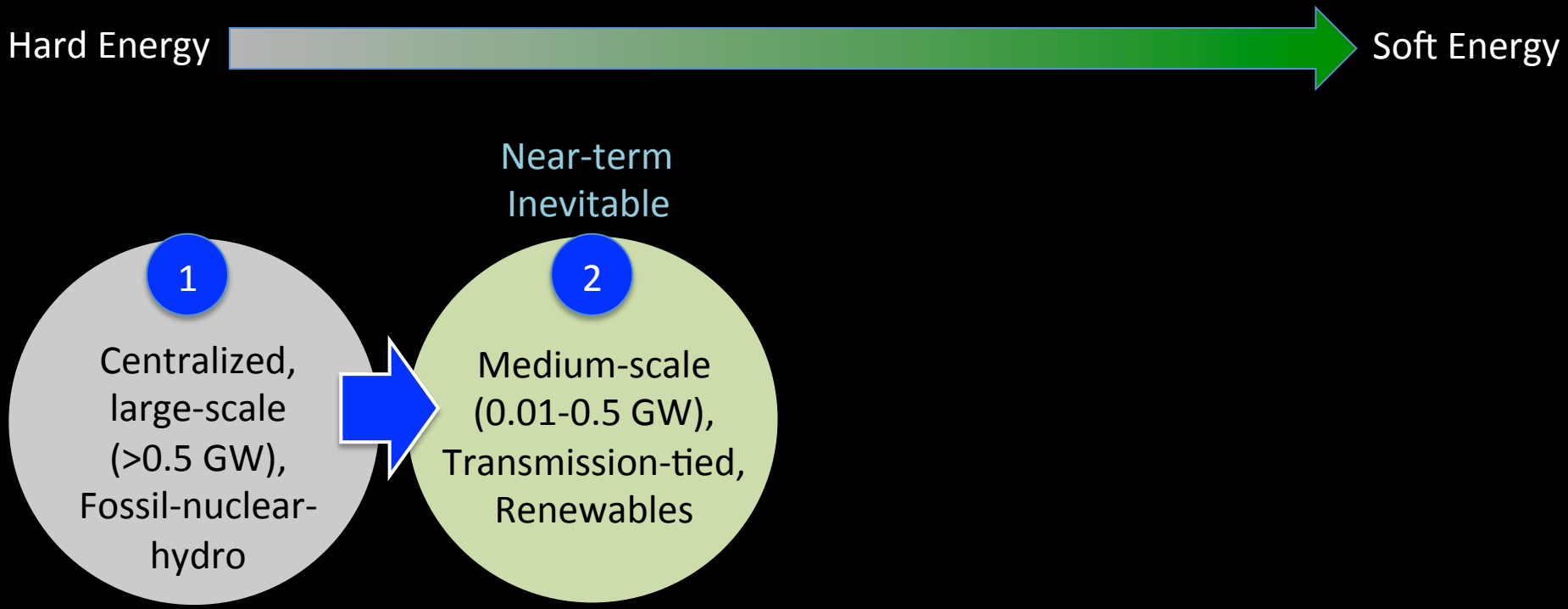
**HI above 50% depending on biodiesel use in fuel oil-fired generation*

4 Step Path



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4 Step Path

Near-term
Inevitable

2

Medium-scale (0.01-0.5 GW), Transmission-tied, Renewables

- No States based on Capacity.
- No States based on Generation.
- Majority of States based on New Build Capacity

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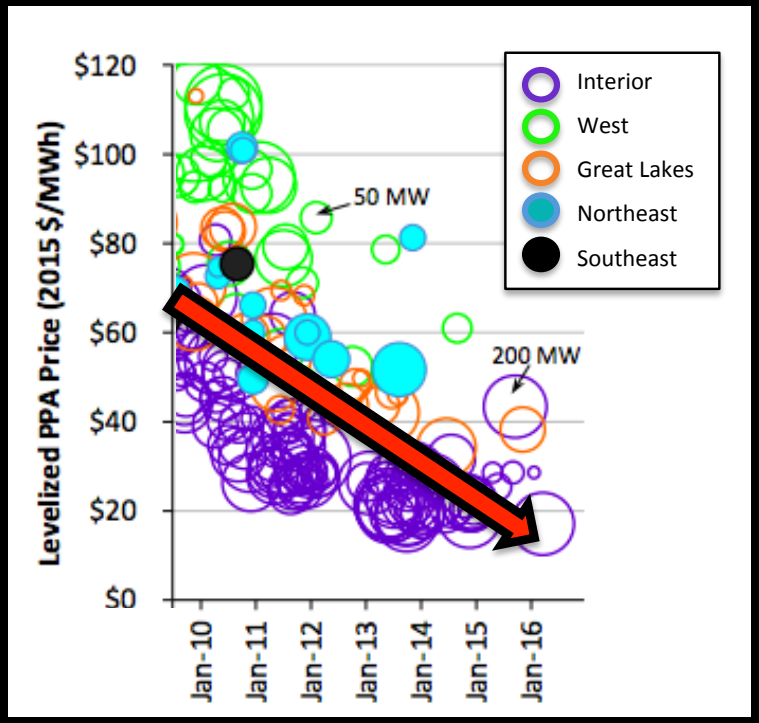
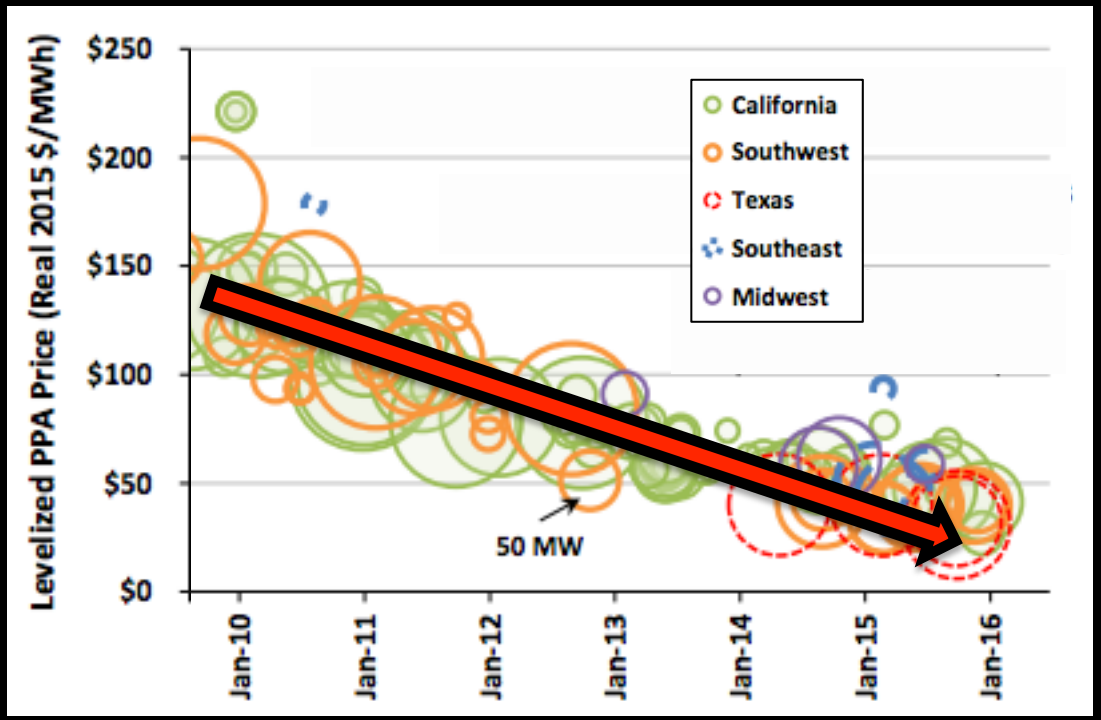
Wind



Source: LBNL, 2016

Solar



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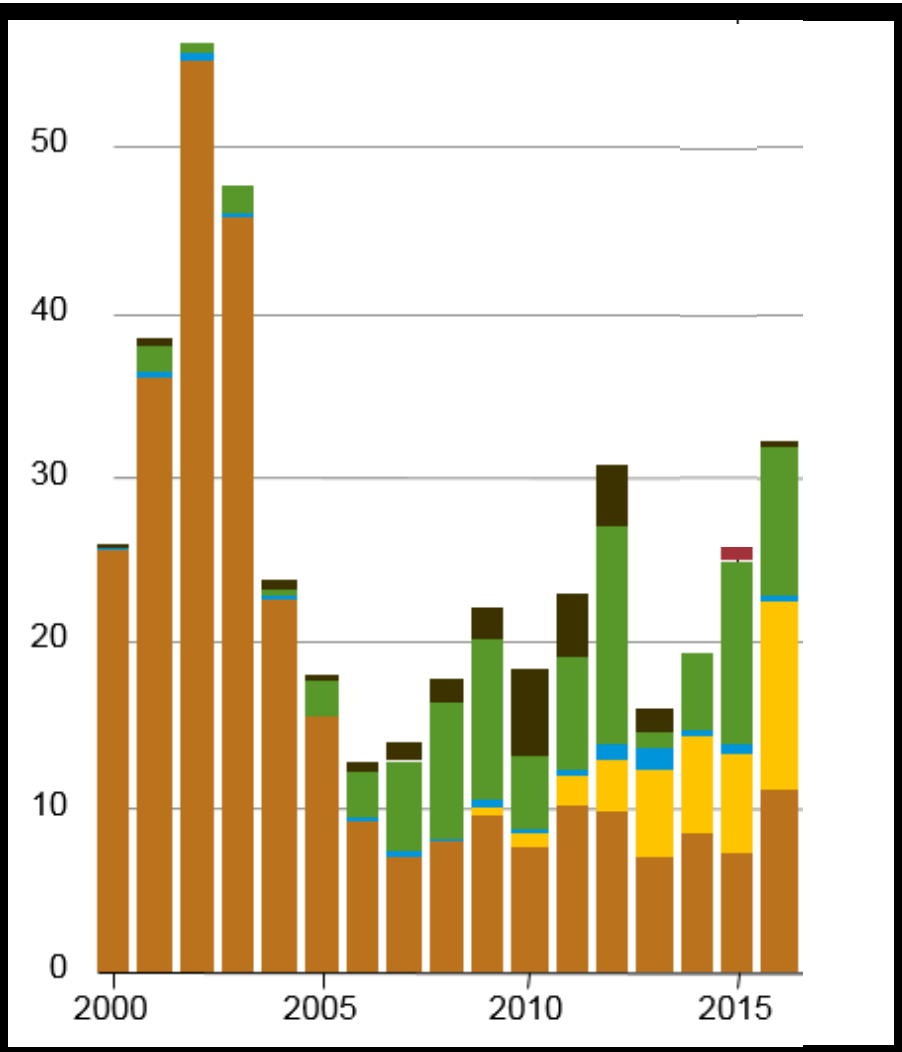
New US Power Capacity (GW)



Source: DOE EIA

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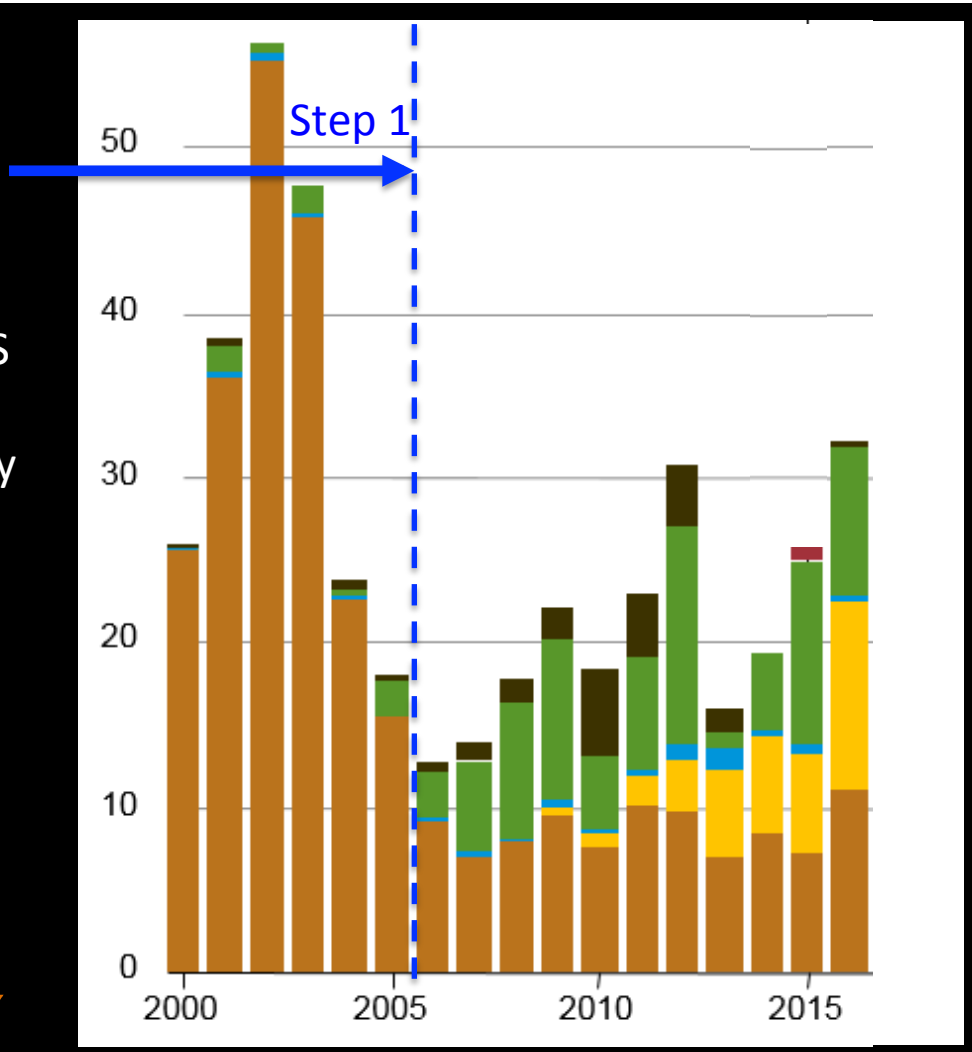

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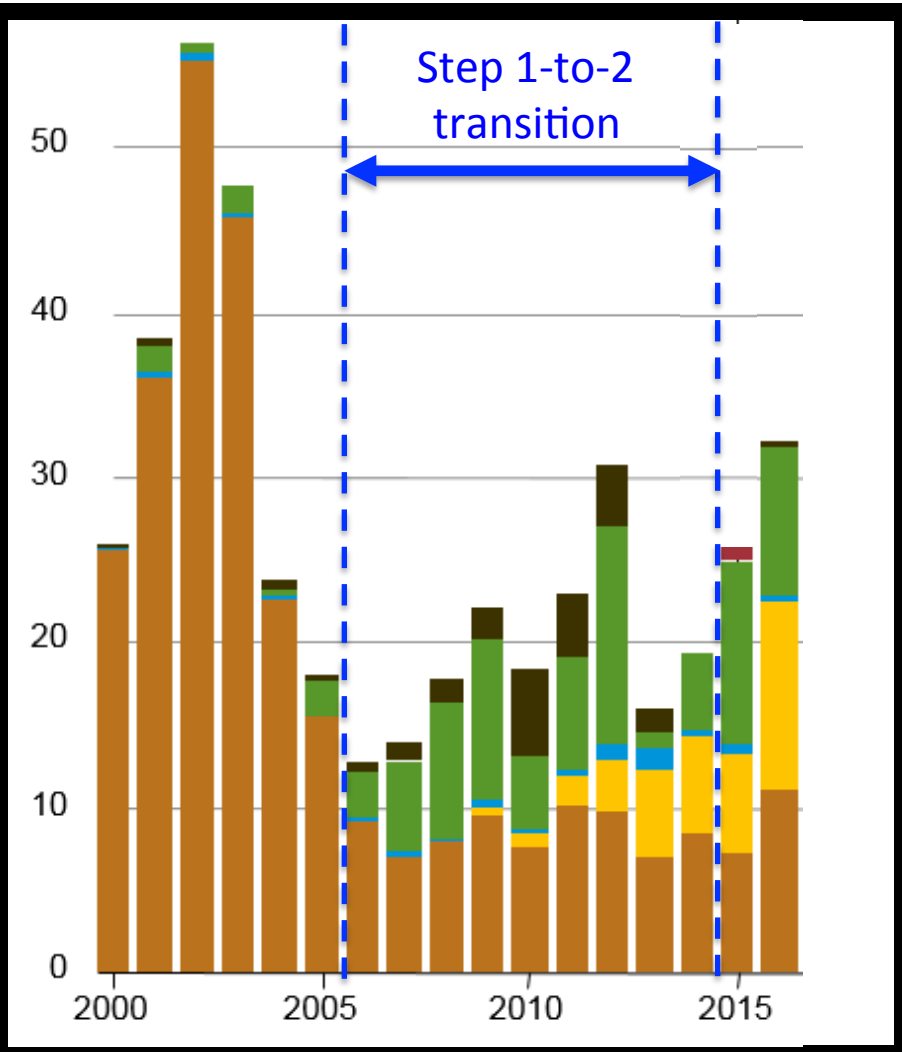

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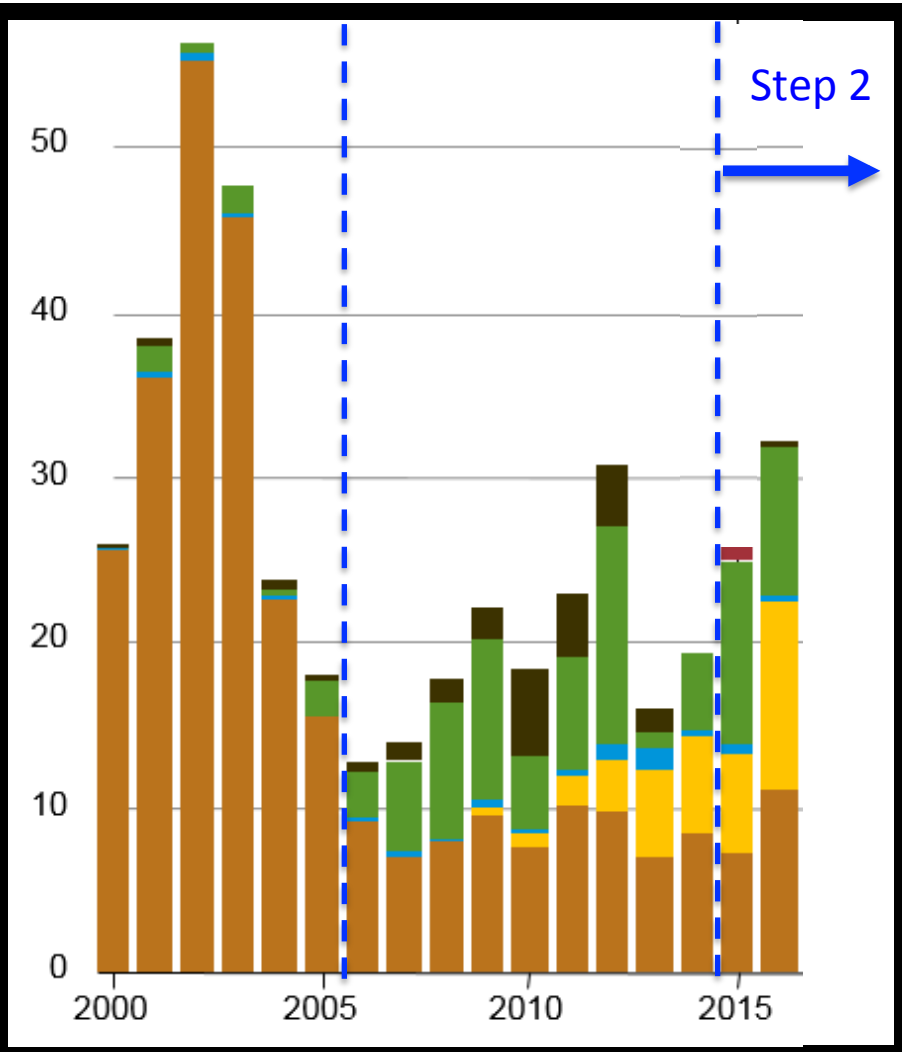

Source: DOE EIA, 2016

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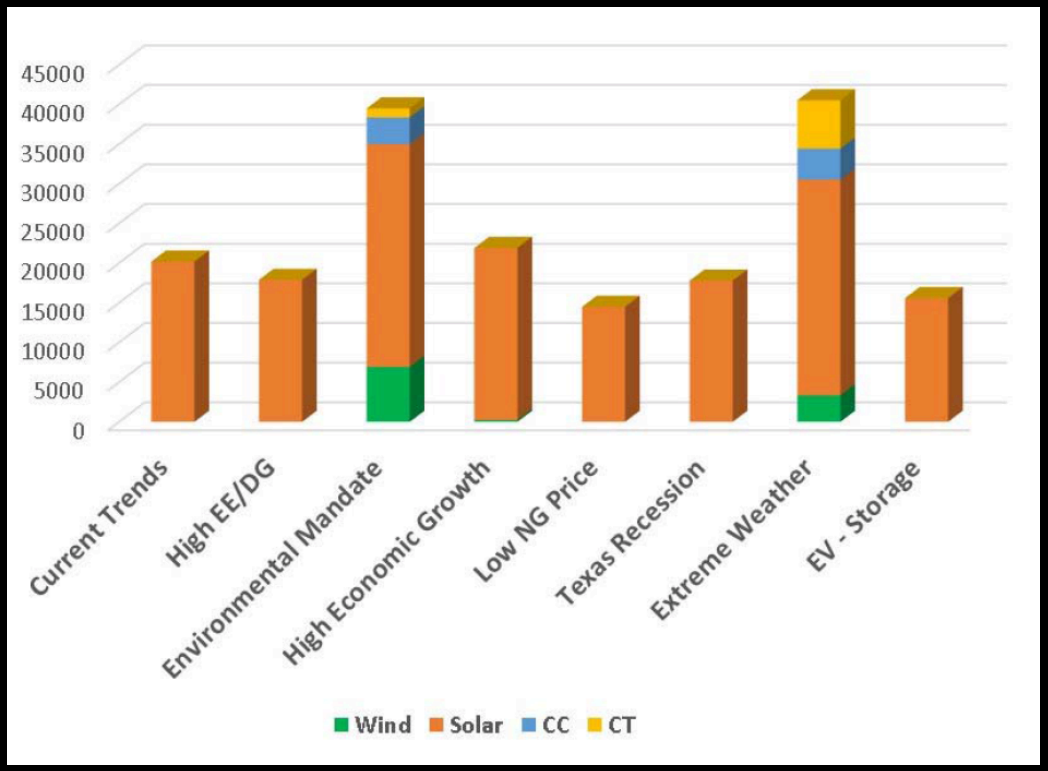
For Texas, solar, solar, and more solar (utility-scale)……..

Projected 2017-2031 New Build Power Capacity in ERCOT (MW)



Source: ERCOT, 12/2016

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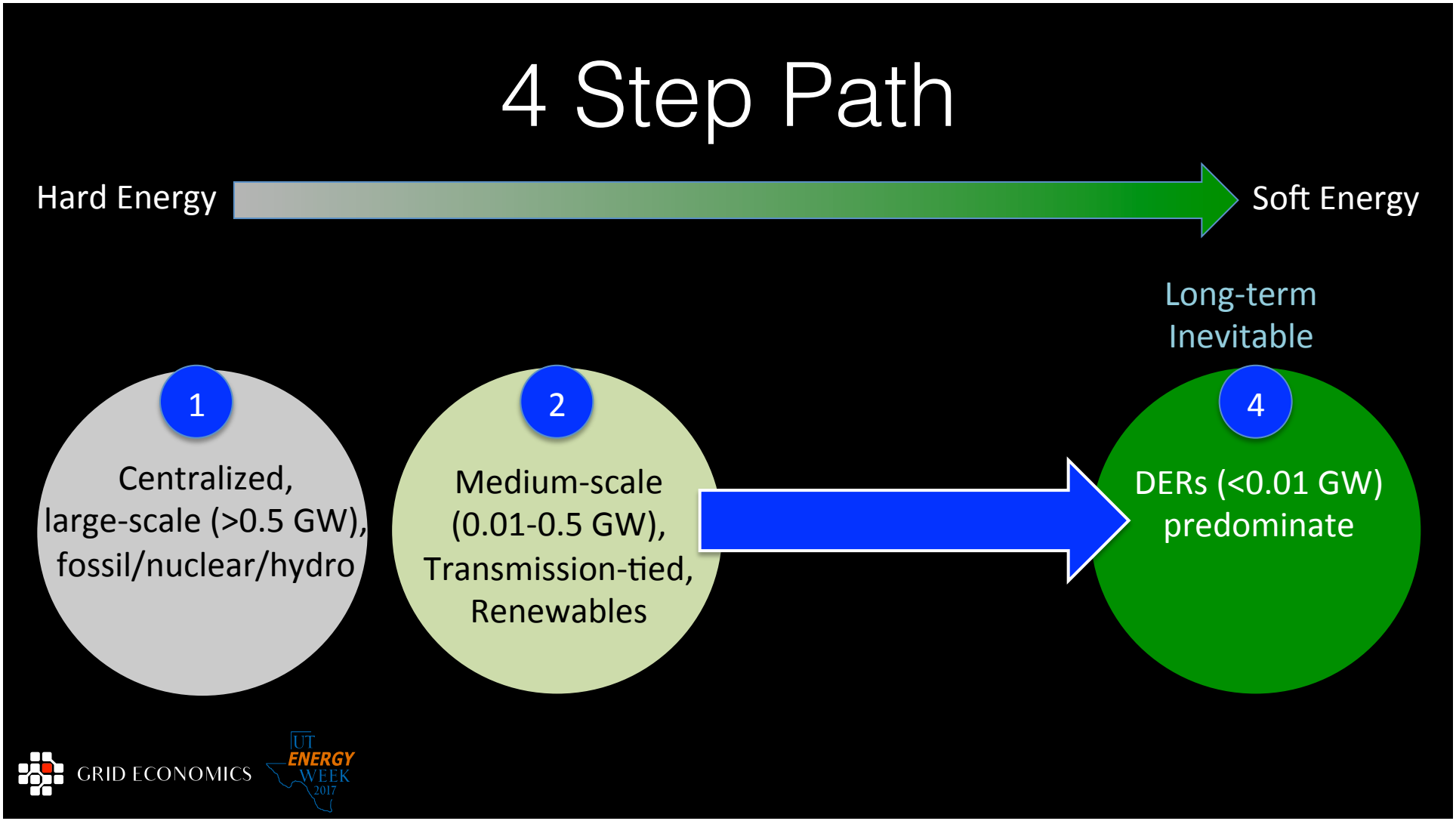

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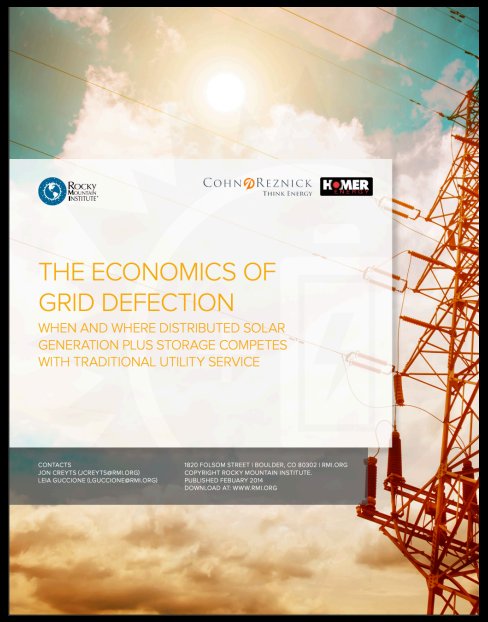
Off-Grid residential economics beat utility rates for much of US within 20 years

Released 2/14



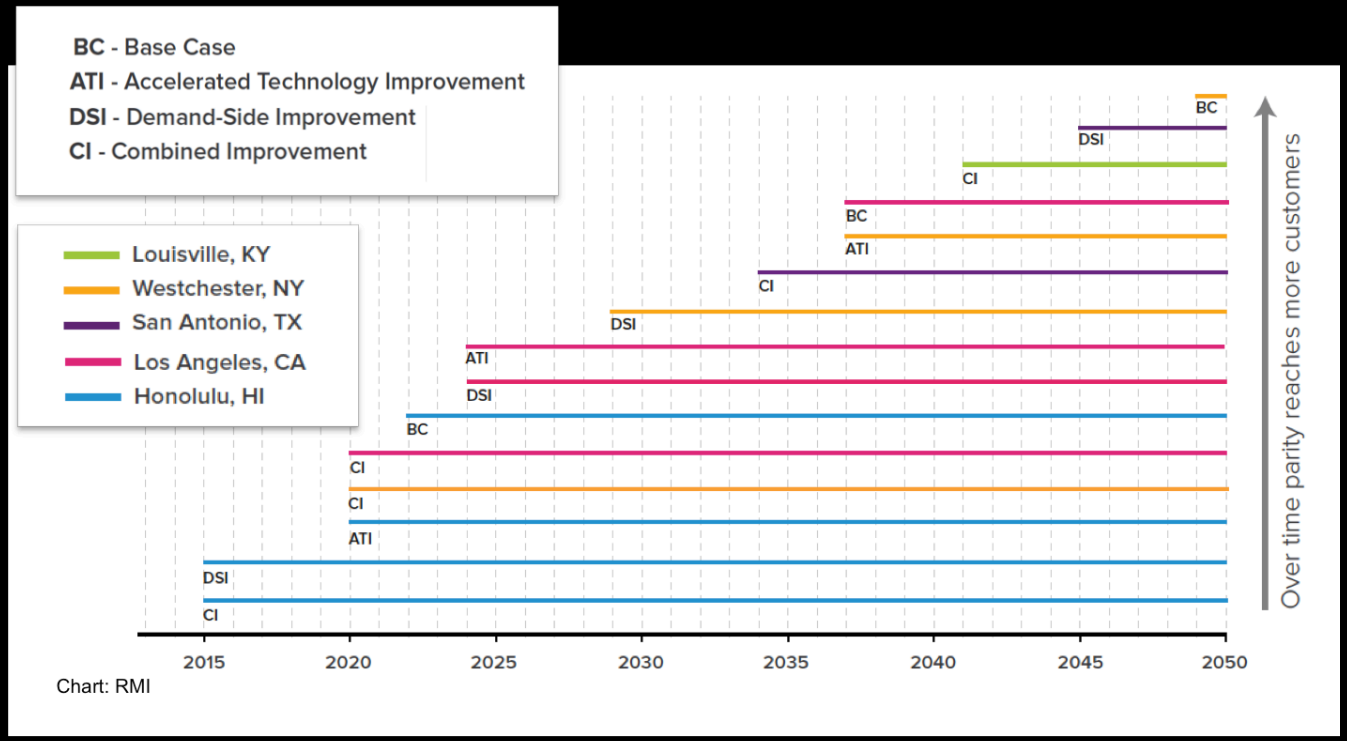


Chart: RMI

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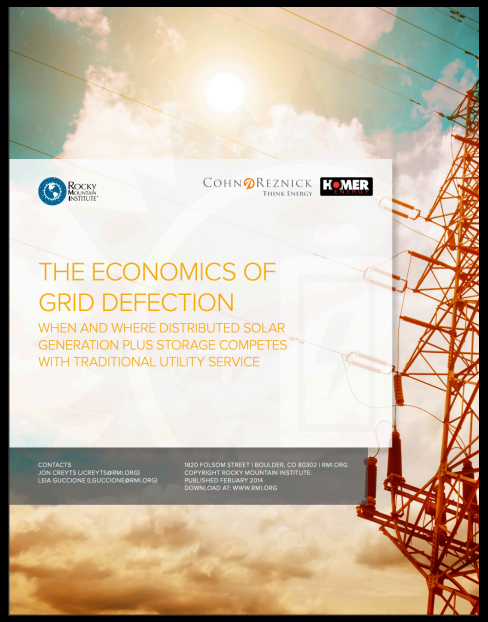

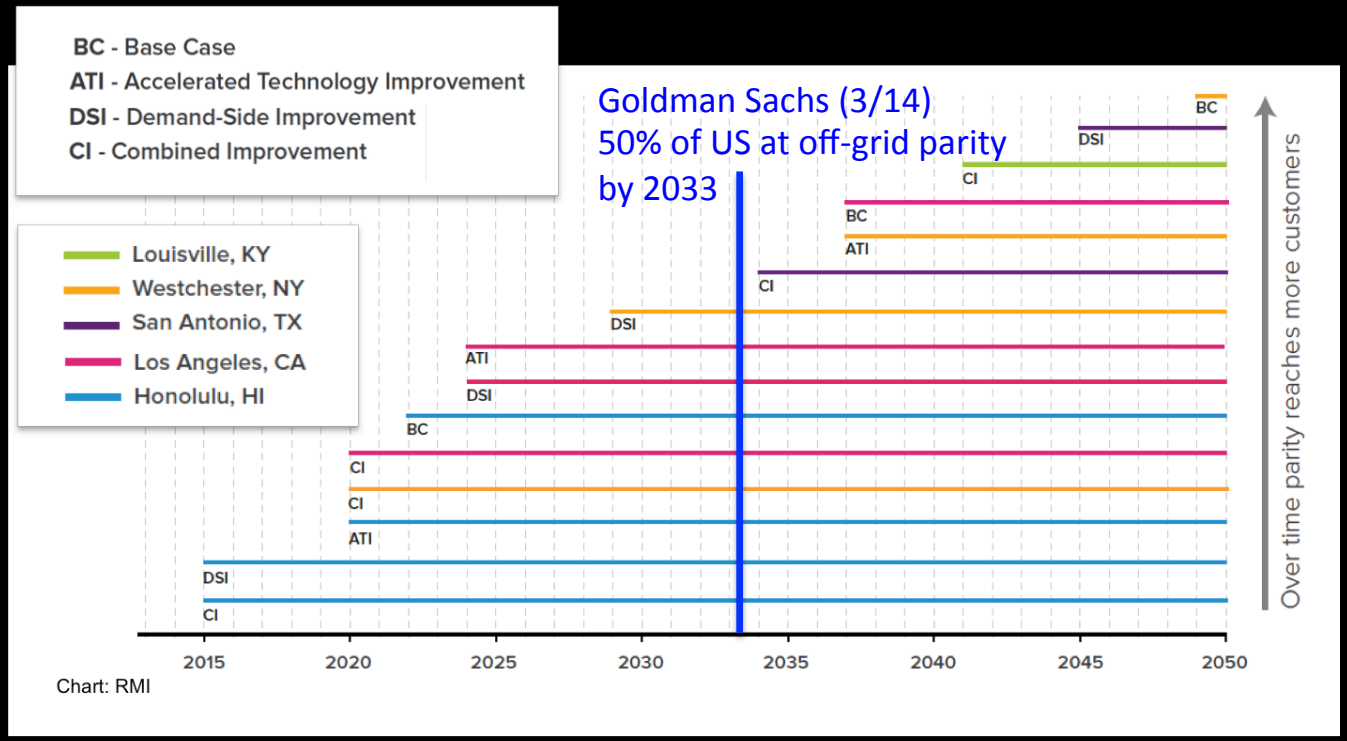

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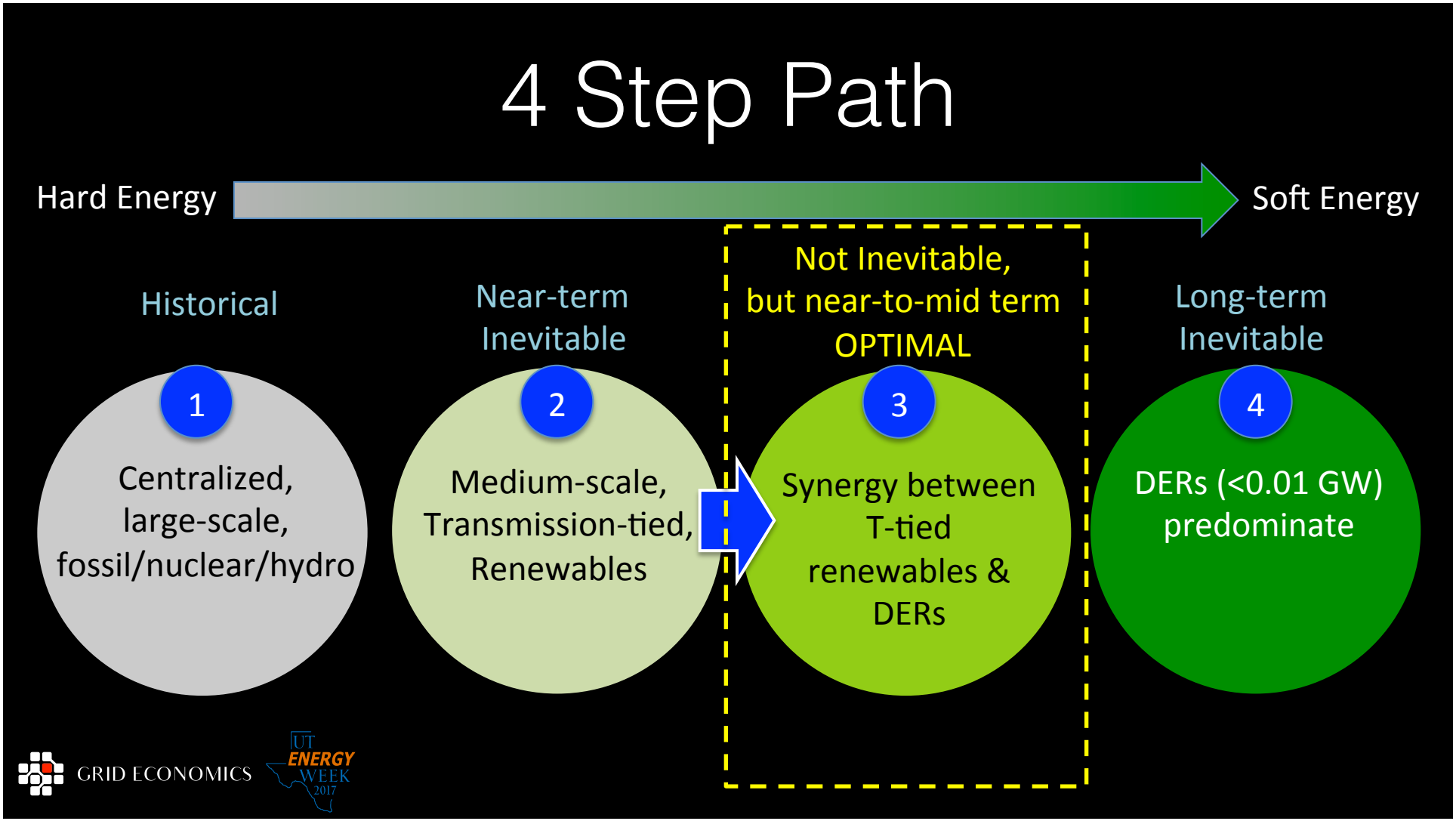
Hard Energy
Soft Energy
Historical
Near-term Inevitable
Not Inevitable, but near-to-mid term OPTIMAL
Long-term Inevitable
1
2
3
4
Centralized, large-scale, fossil/nuclear/hydro
Medium-scale, Transmission-tied, Renewables
Synergy between T-tied renewables & DERs
DERs (<0.01 GW) predominate
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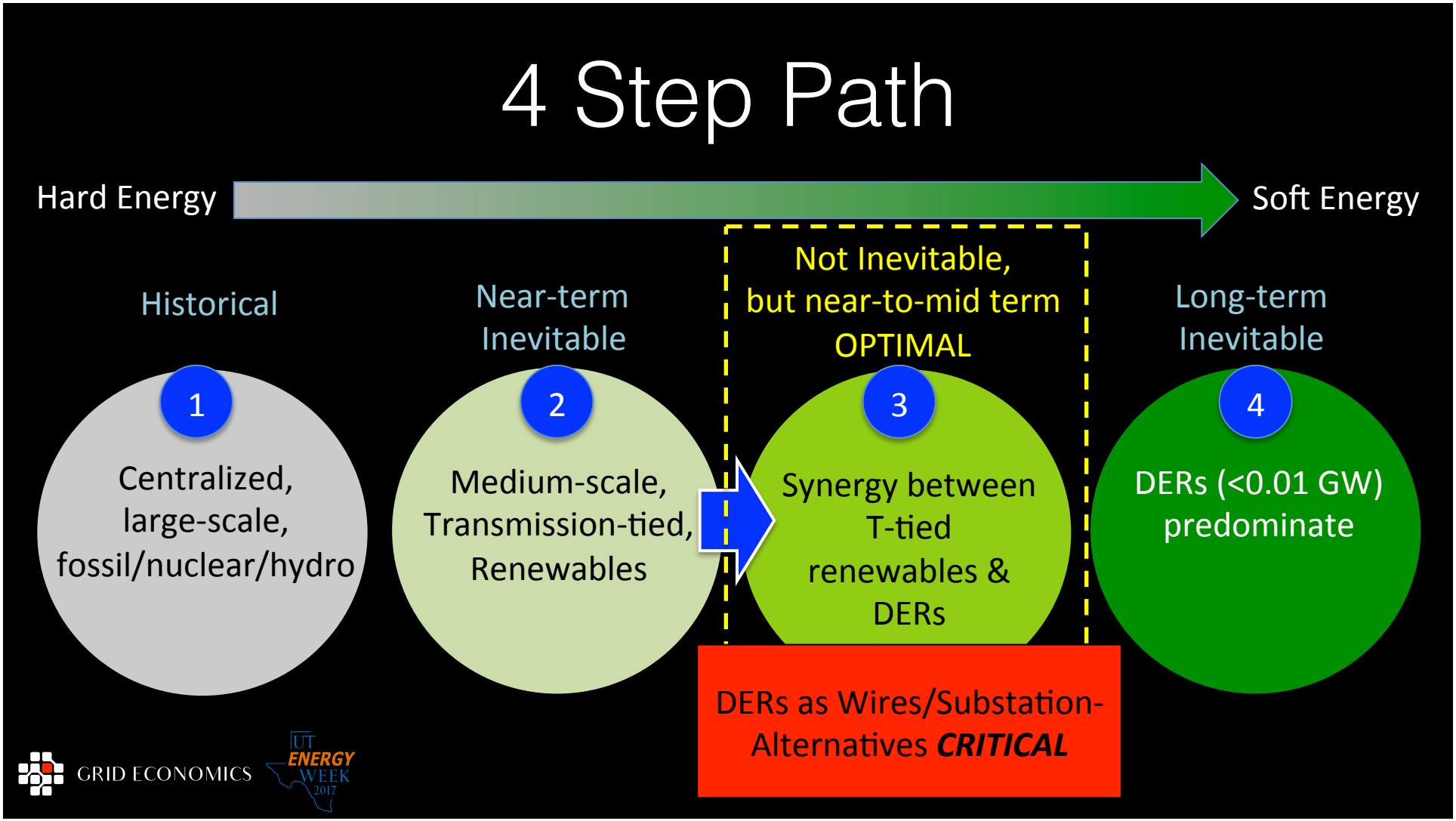
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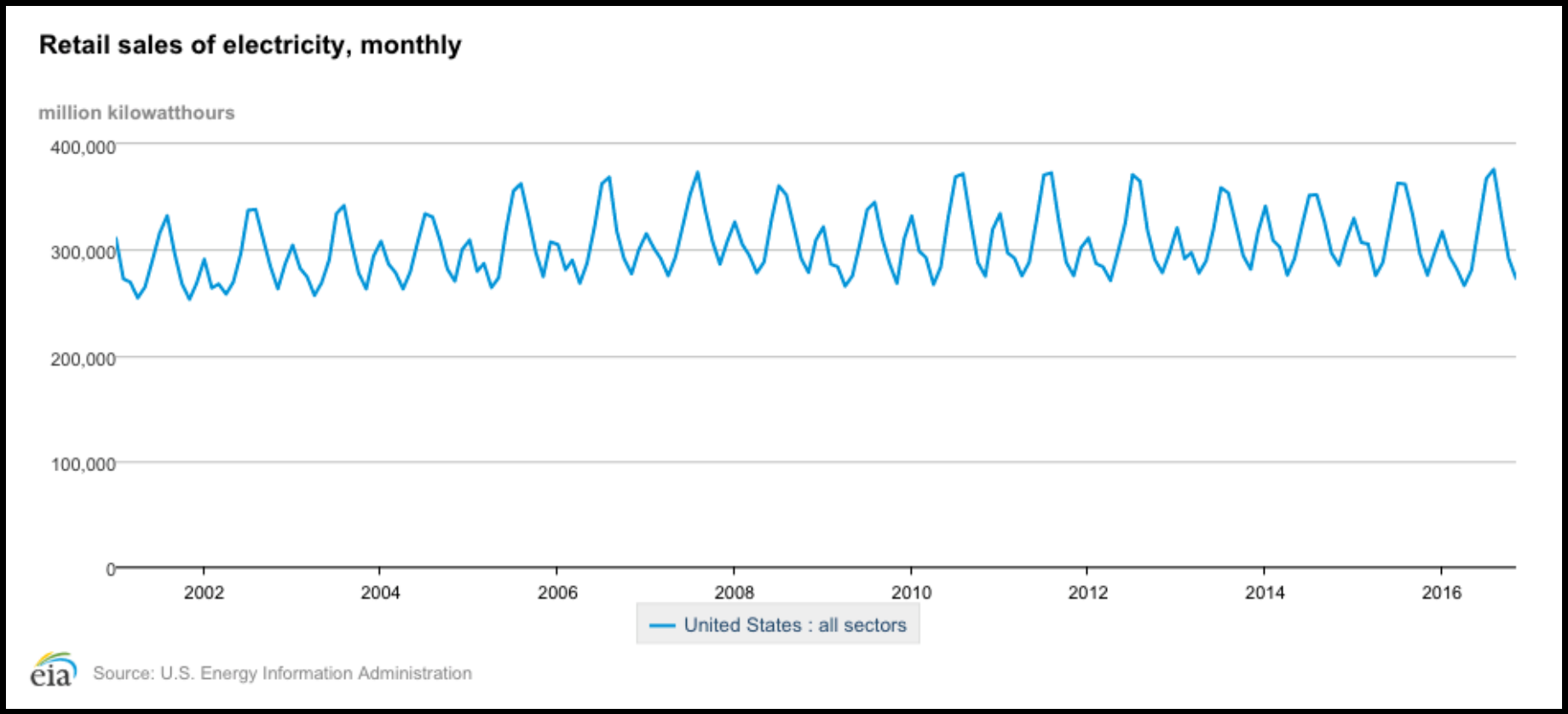
Efficiency dominating, driving up T&D retail bill costs….



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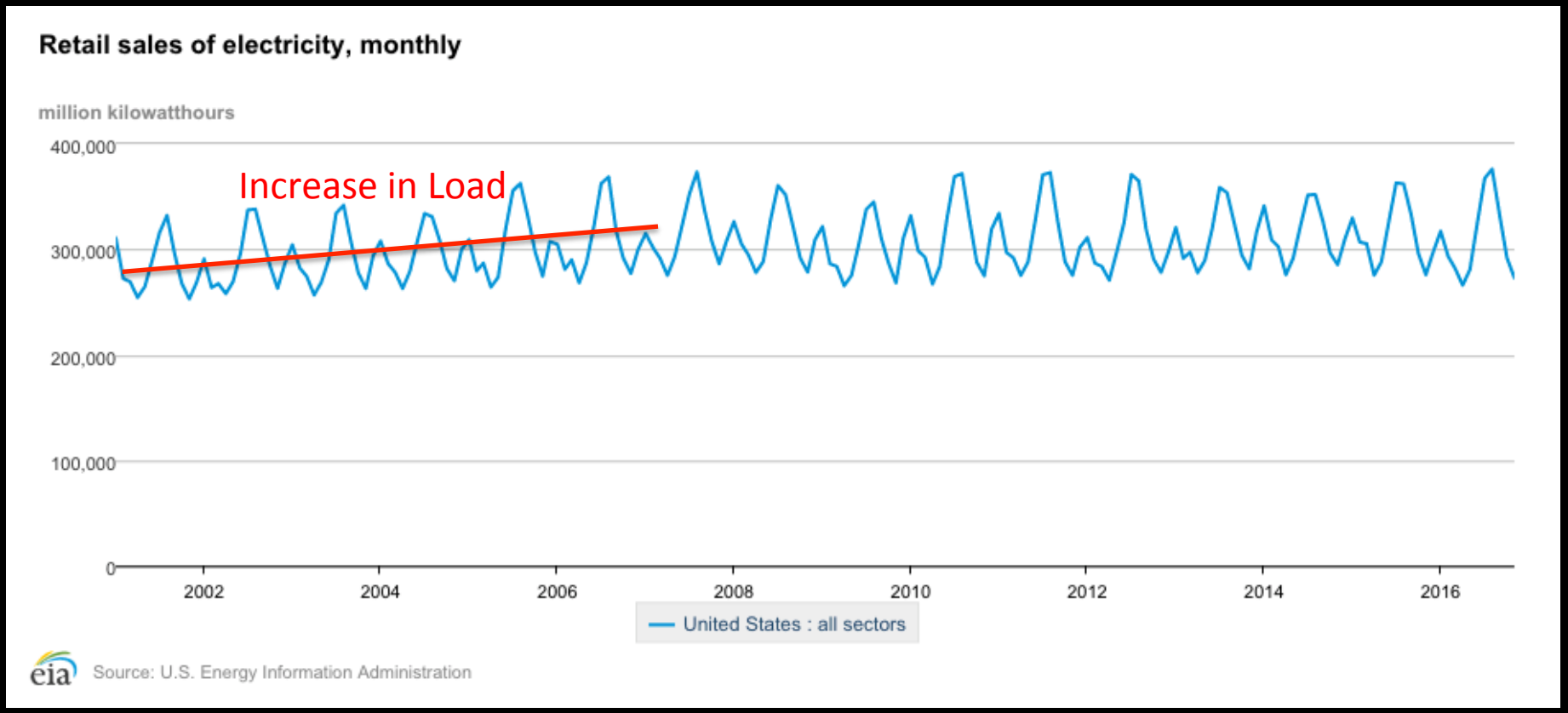

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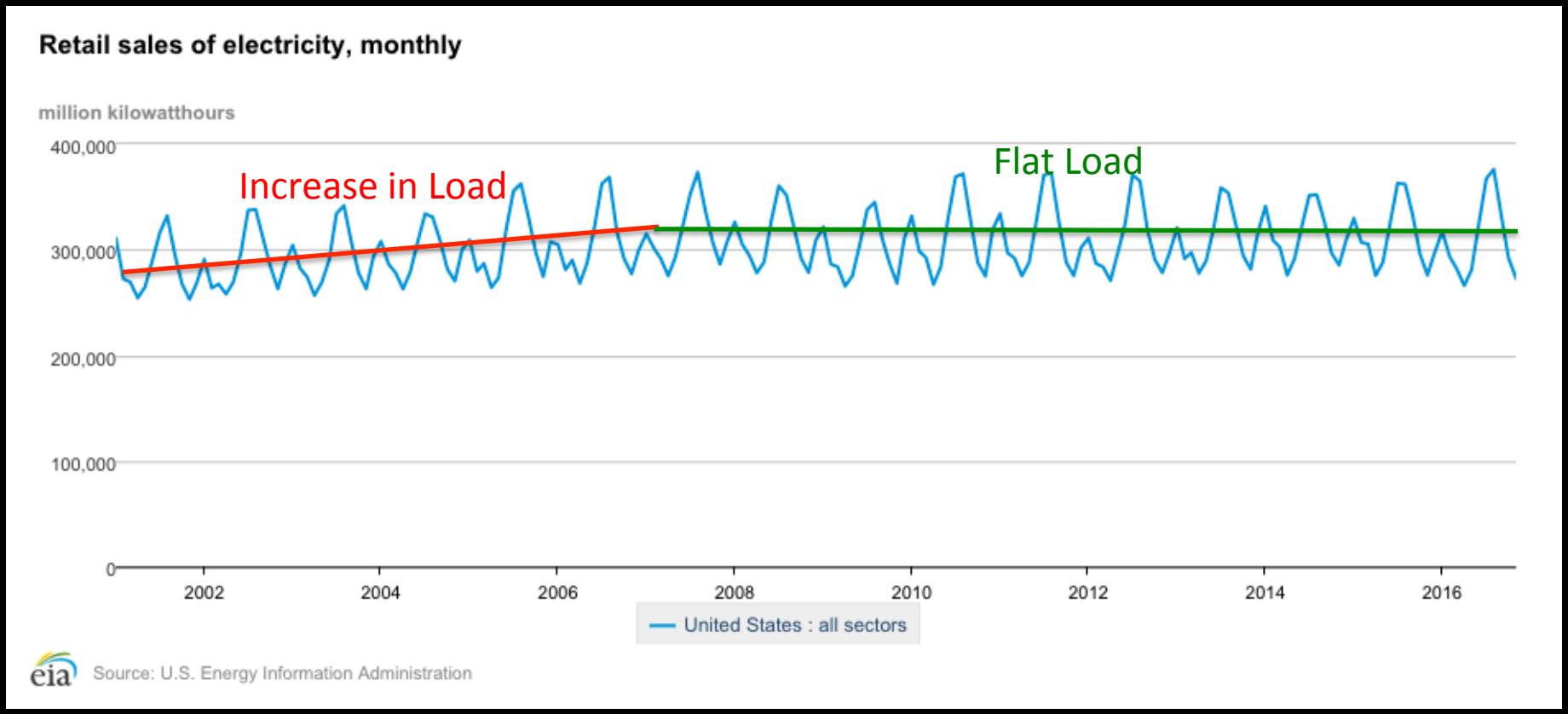

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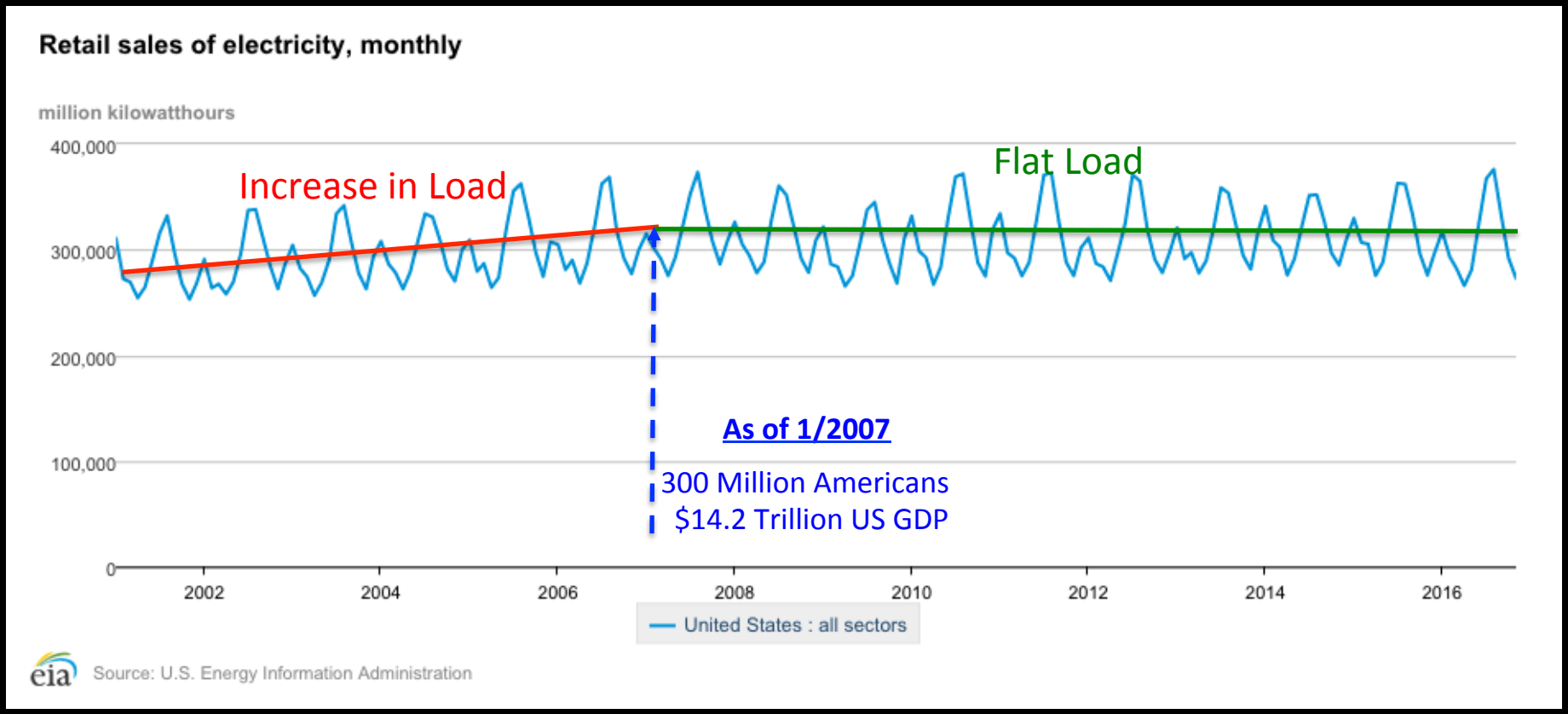

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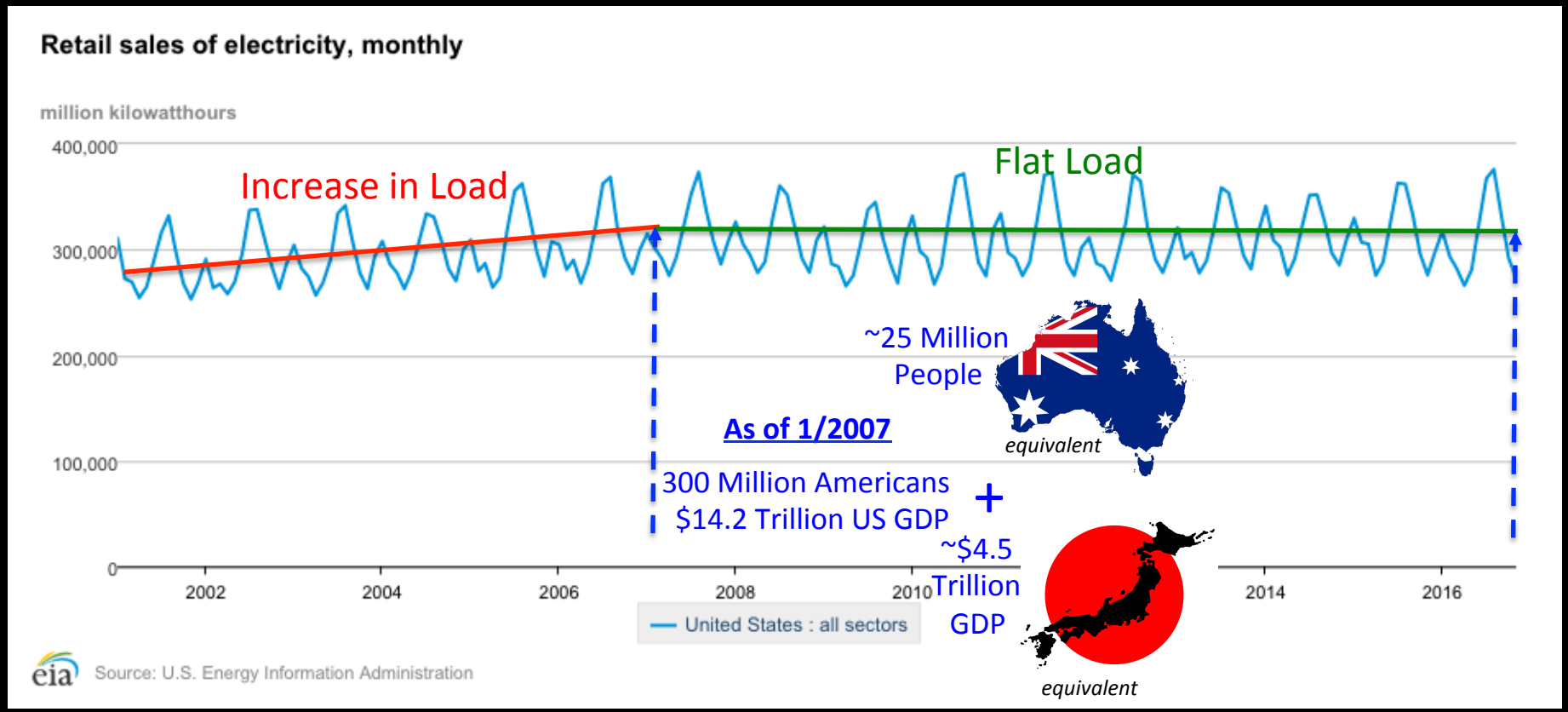

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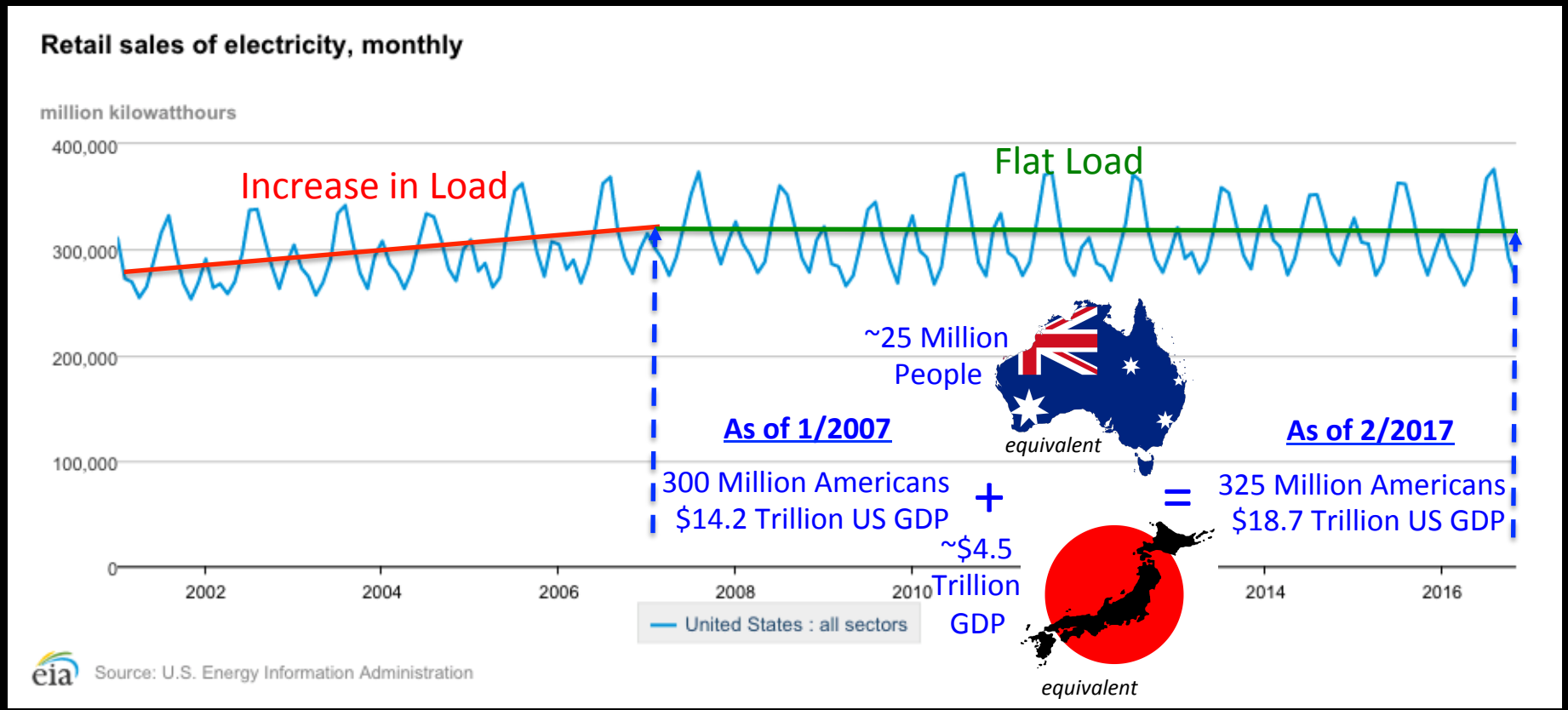

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US Industrial employment might not be great…, but US industrial activity is fine….

US Manufacturing Purchasing Managers Index (PMI)

Source: Quandle.com

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UT ENERGY WEEK 2017

Source: Rocky Mountain Institute; derived from FERC data

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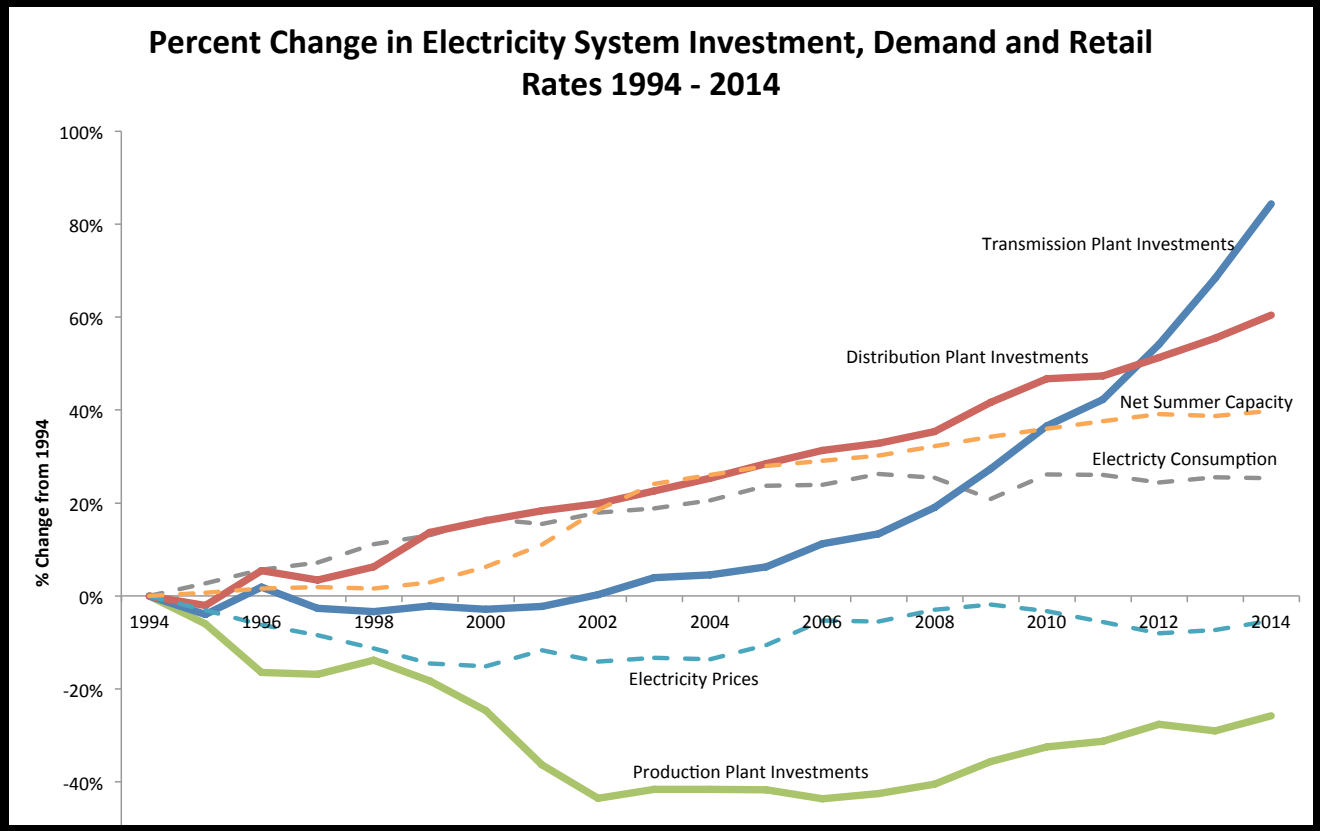
Meanwhile, T&D (particularly T) spending way up…further escalating T&D costs….



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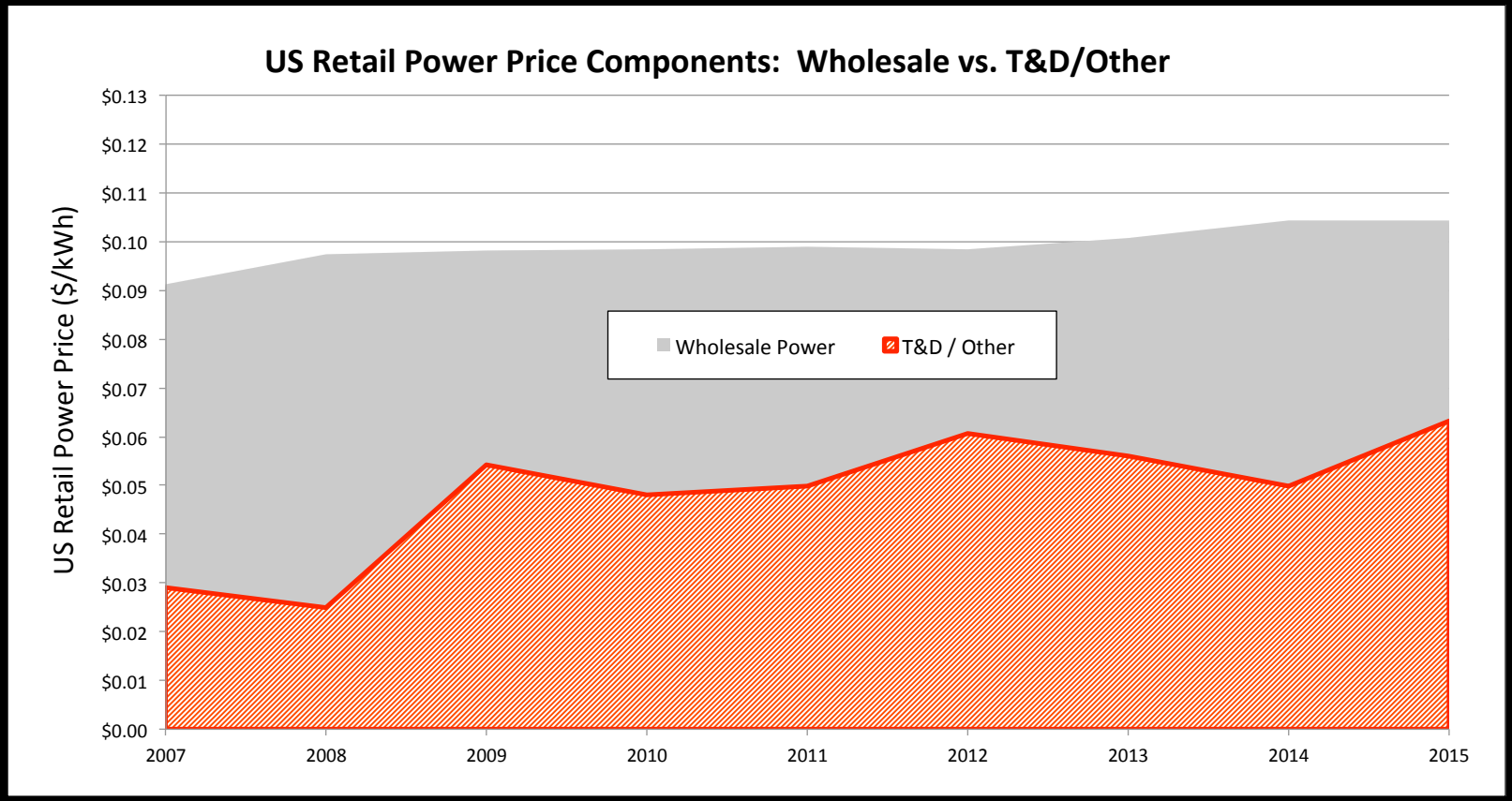
FLAT LOAD + INCREASED T&D SPENDING = T&D COSTs SKYROCKETING



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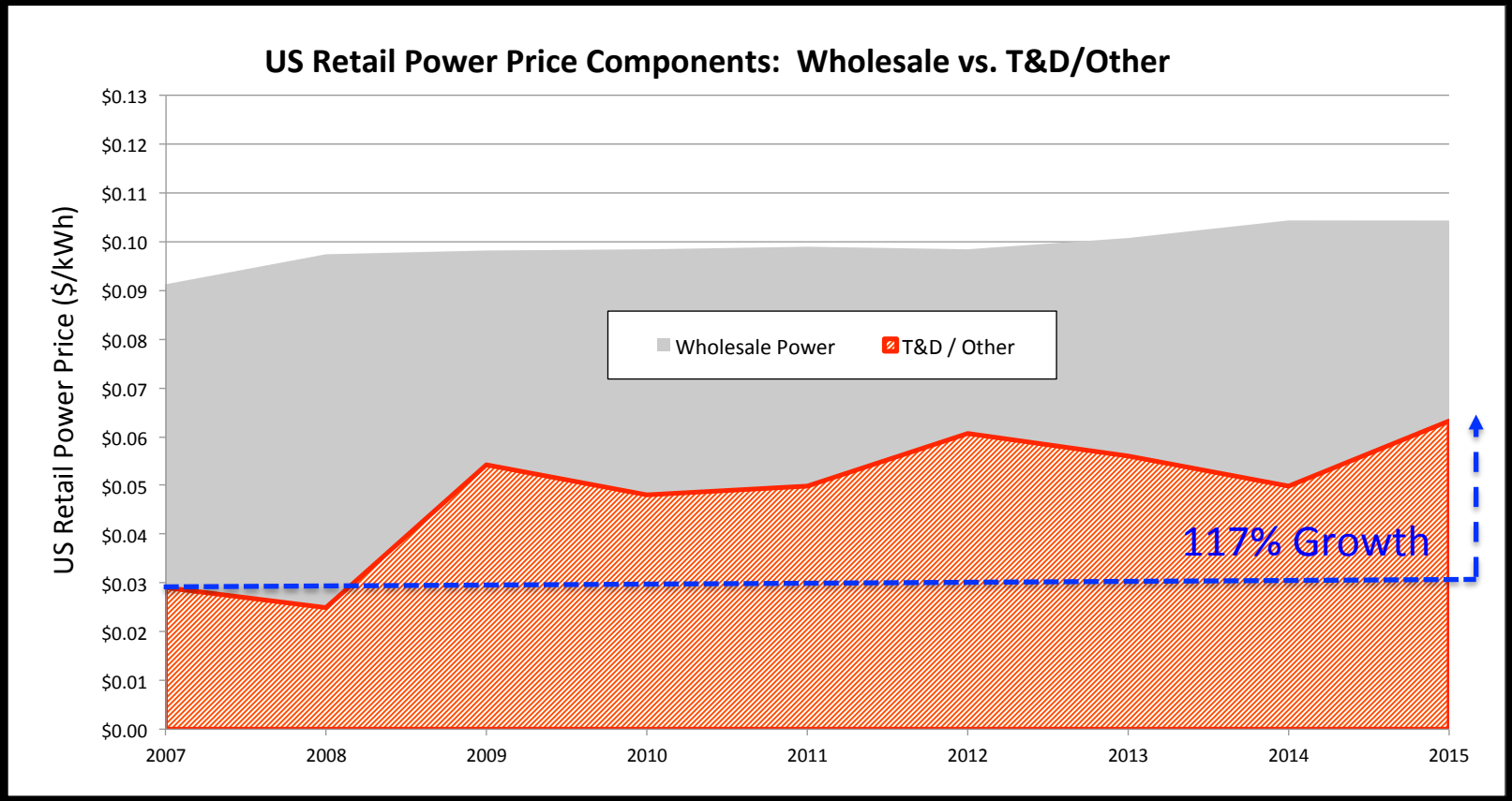

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SUMMARY

- In era of utility-scale renewable new build dominance
- Can extend period of economic viability of utility-scale renewables by decreasing T&D costs. DERs are critical to this solution. Not US vs. THEM; but US & THEM
- DERs dominate in the end; But in 10 years…. or 30???