Facts Shaping Bermuda's Future

Karl McDermott

Ameren Distinguished Professor University of Illinois Springfield

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The Truth is Out There

What is Really Going on in the Energy Sector?

R. J. Gordon Rise and Fall of American Growth

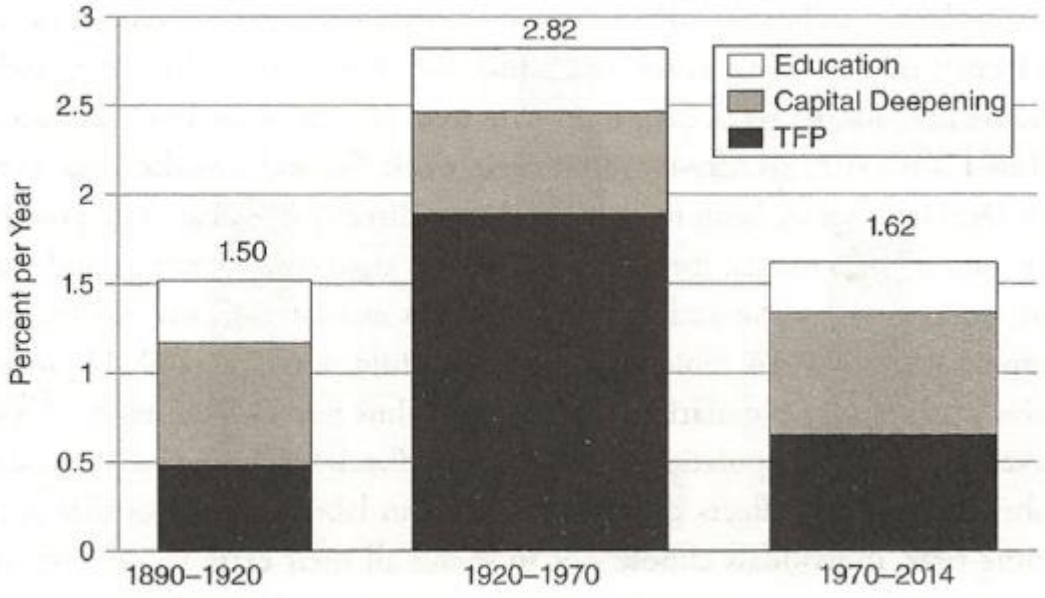
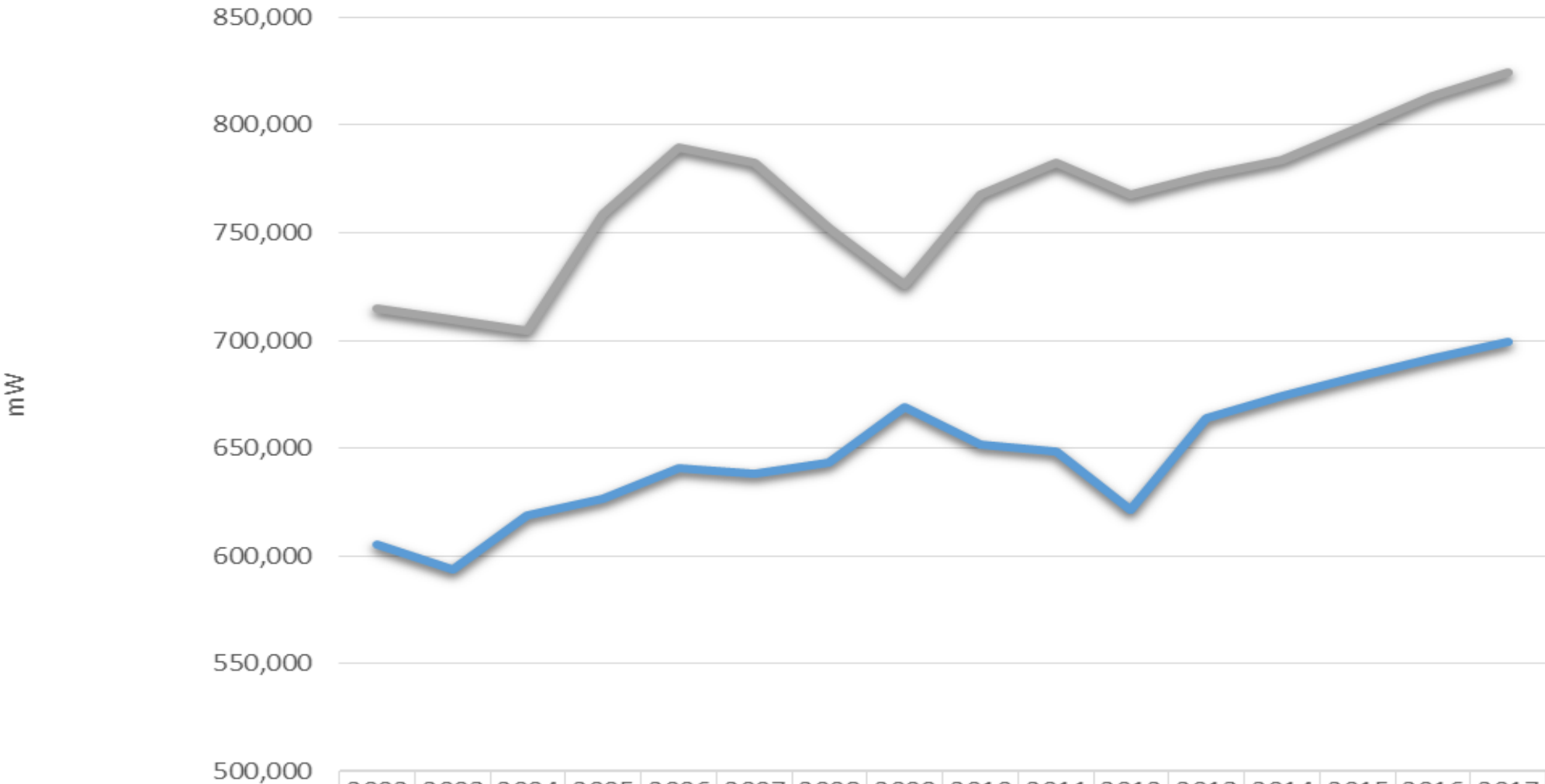


Figure 1–2. Average Annual Growth Rates of Output per Hour and Its Components, Selected Intervals, 1890–2014

Source: See Data Appendix.

US Summer Peak Demand (2002-2017)



	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Total Summer Peak	714,5	709,3	704,4	758,8	789,4	782,2	752,4	725,9	767,9	782,4	767,7	777,0	784,0	798,7	813,5	824,1
Total Winter Peak	604,9	593,8	618,7	626,3	640,9	637,9	643,5	668,8	651,4	648,1	621,3	663,6	674,2	683,2	691,4	699,5

Declining Demand Growth

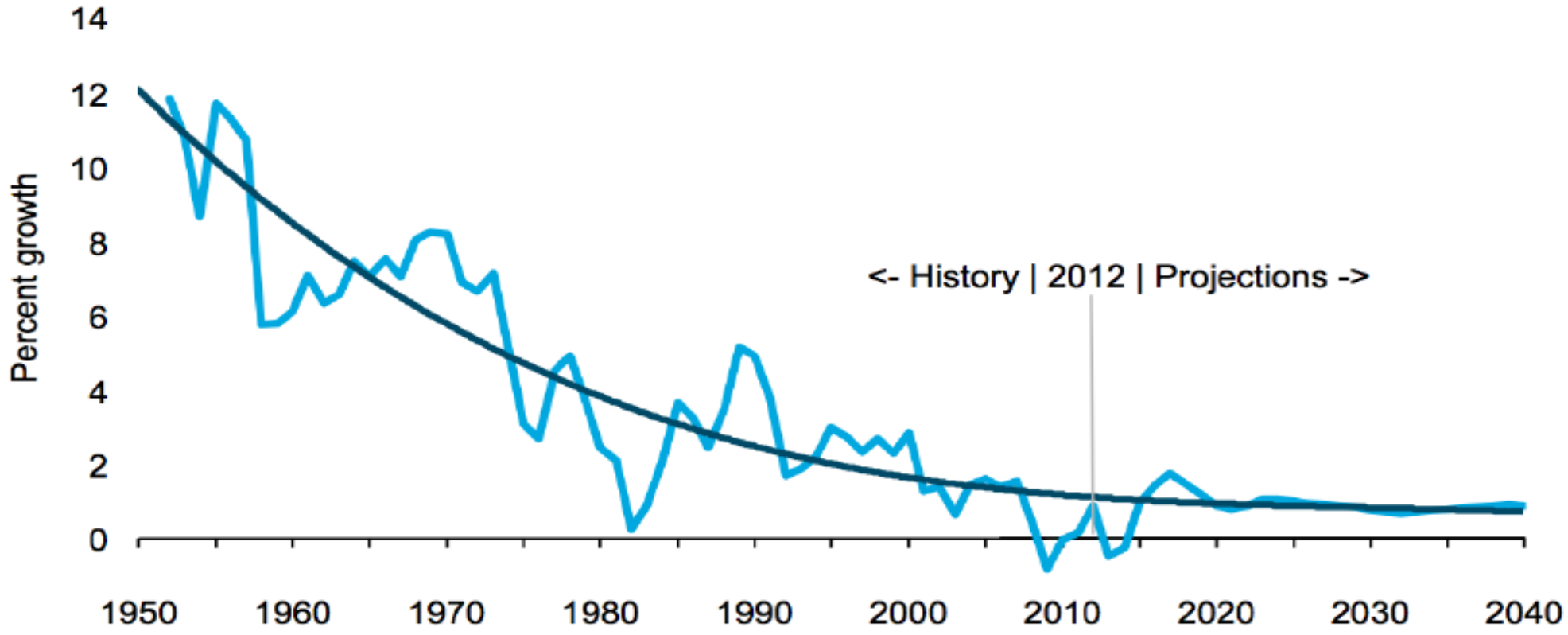
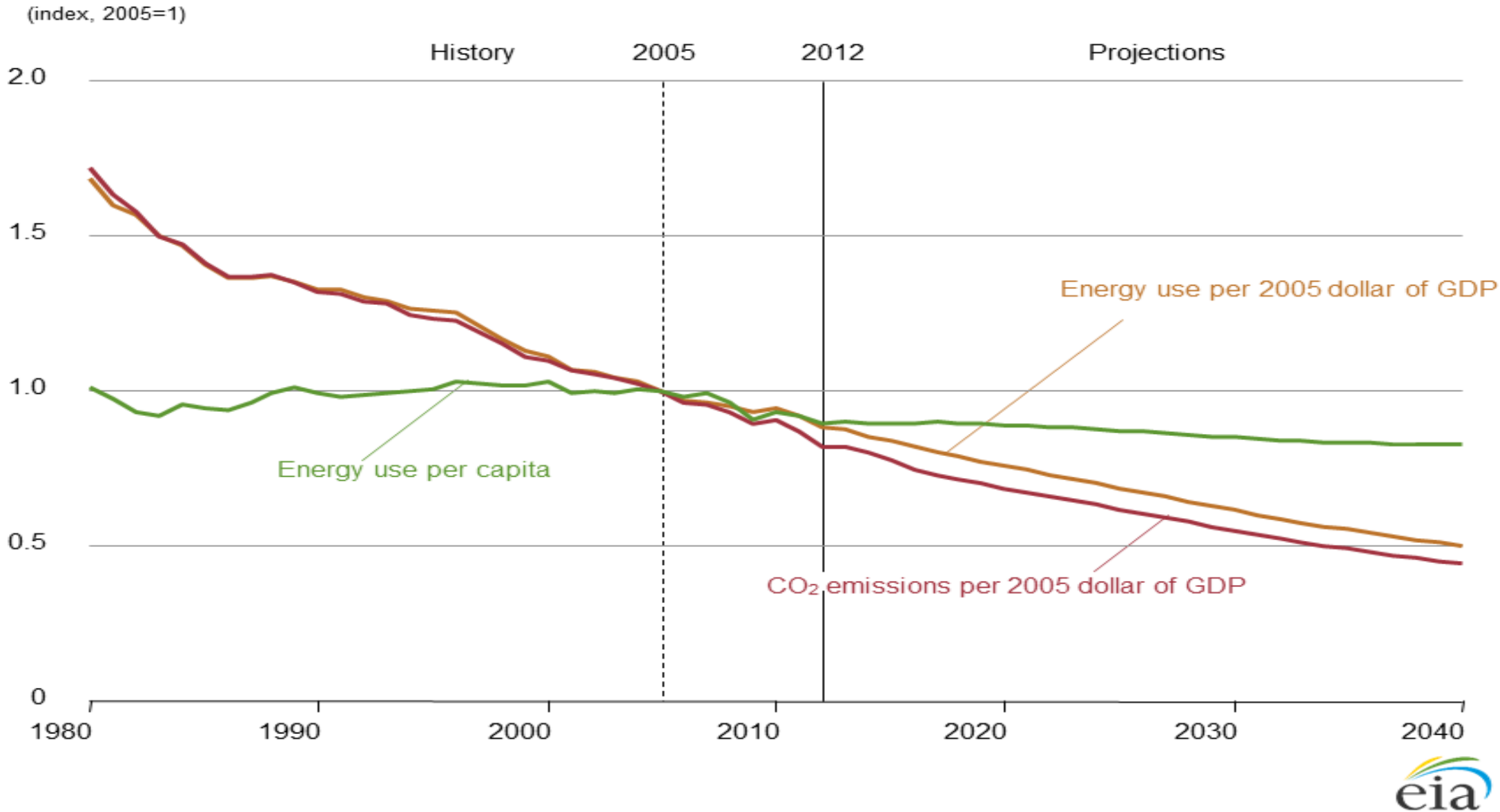


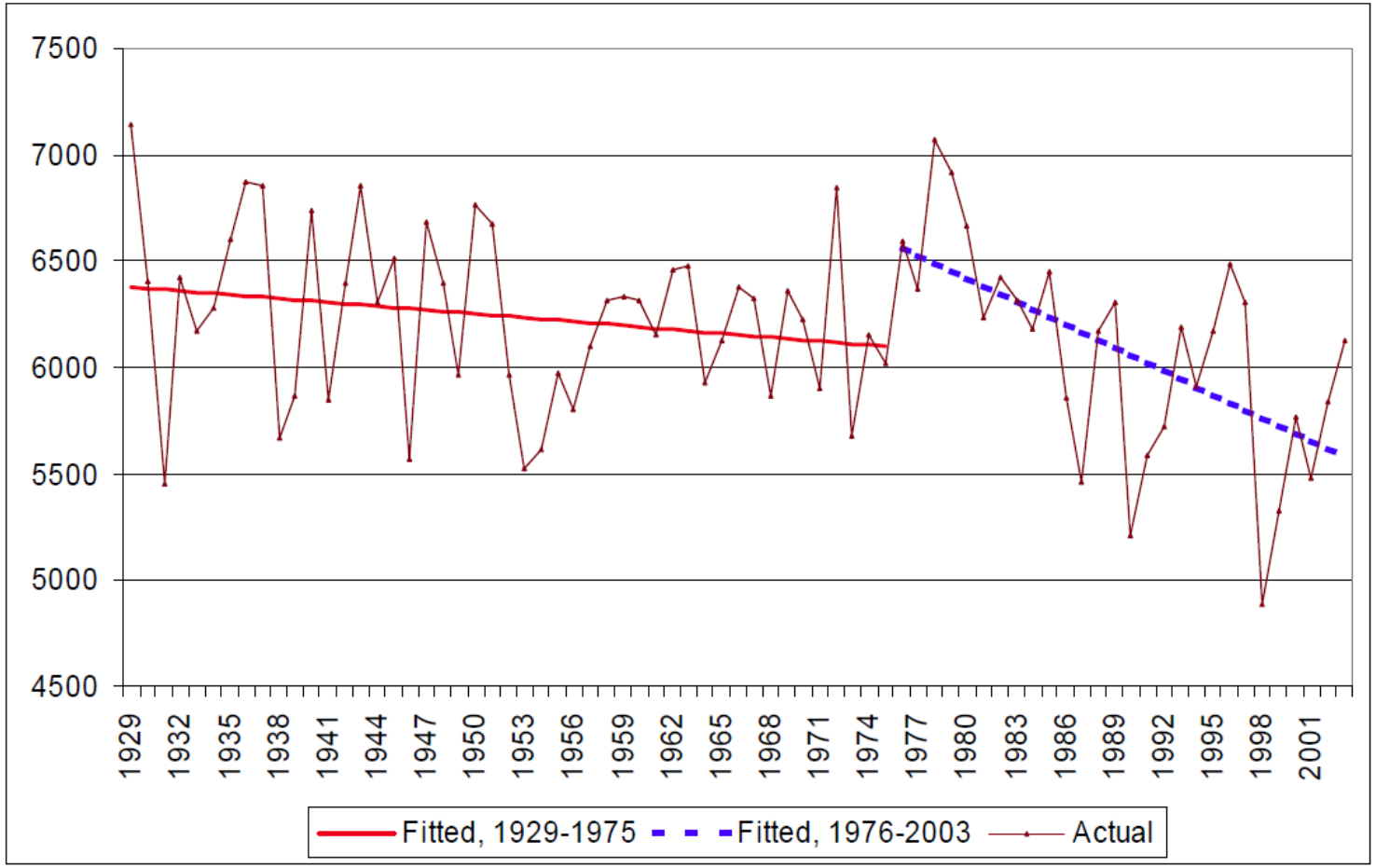
Figure 1. U.S. electricity demand growth, 1950-2035 (percent, 3-year moving average). Figures beyond 2012 are projections and not actual data. *Source:* EIA 2013e.

Figure 9. Energy uses per capita, energy use per dollar of GDP, and emissions per dollar of GDP, 1980-2040



Climate Cycles

Figure 2. Fitted HDD Trend Lines for Two Sub Periods, 1929-1975 and 1976-2003



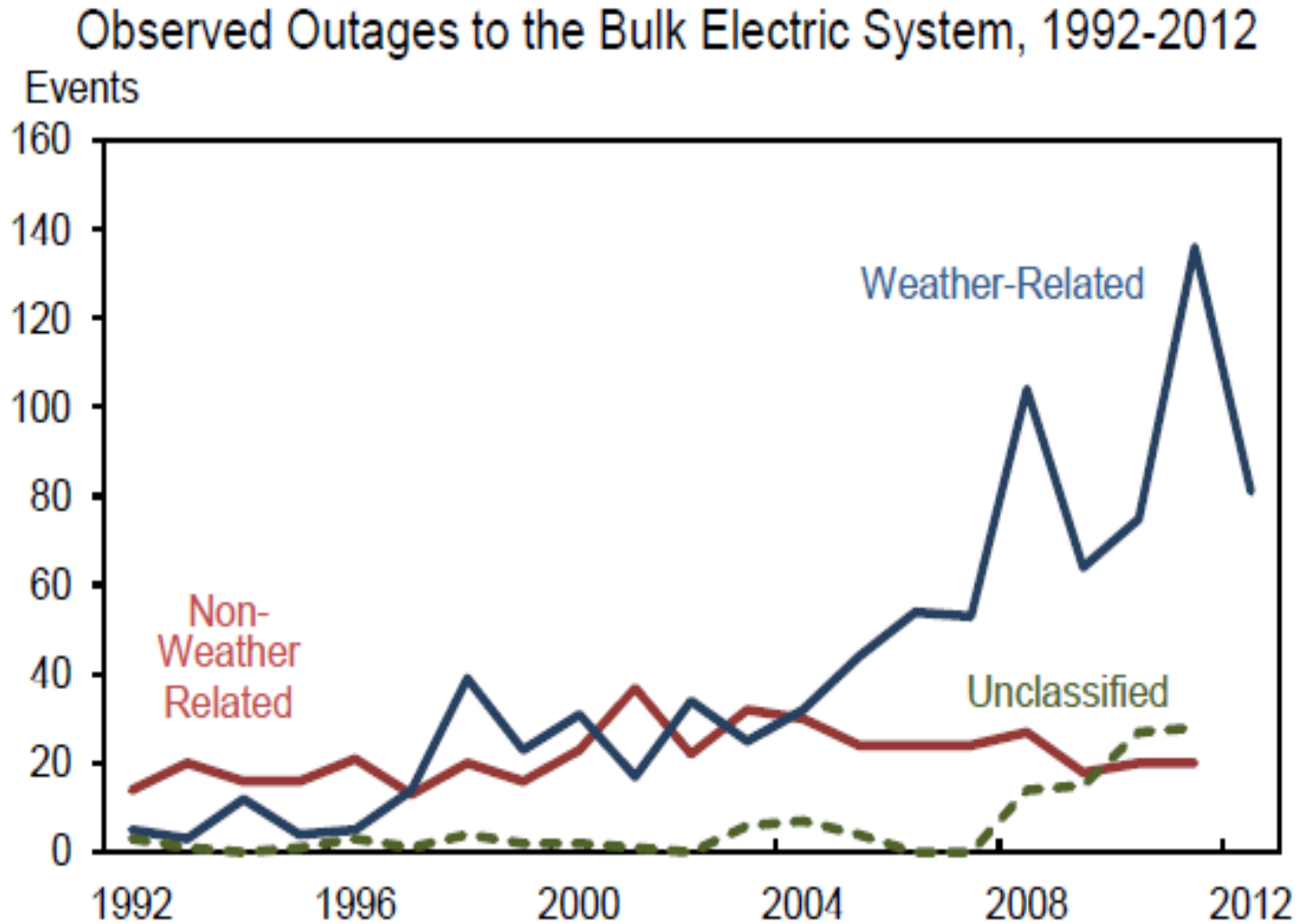
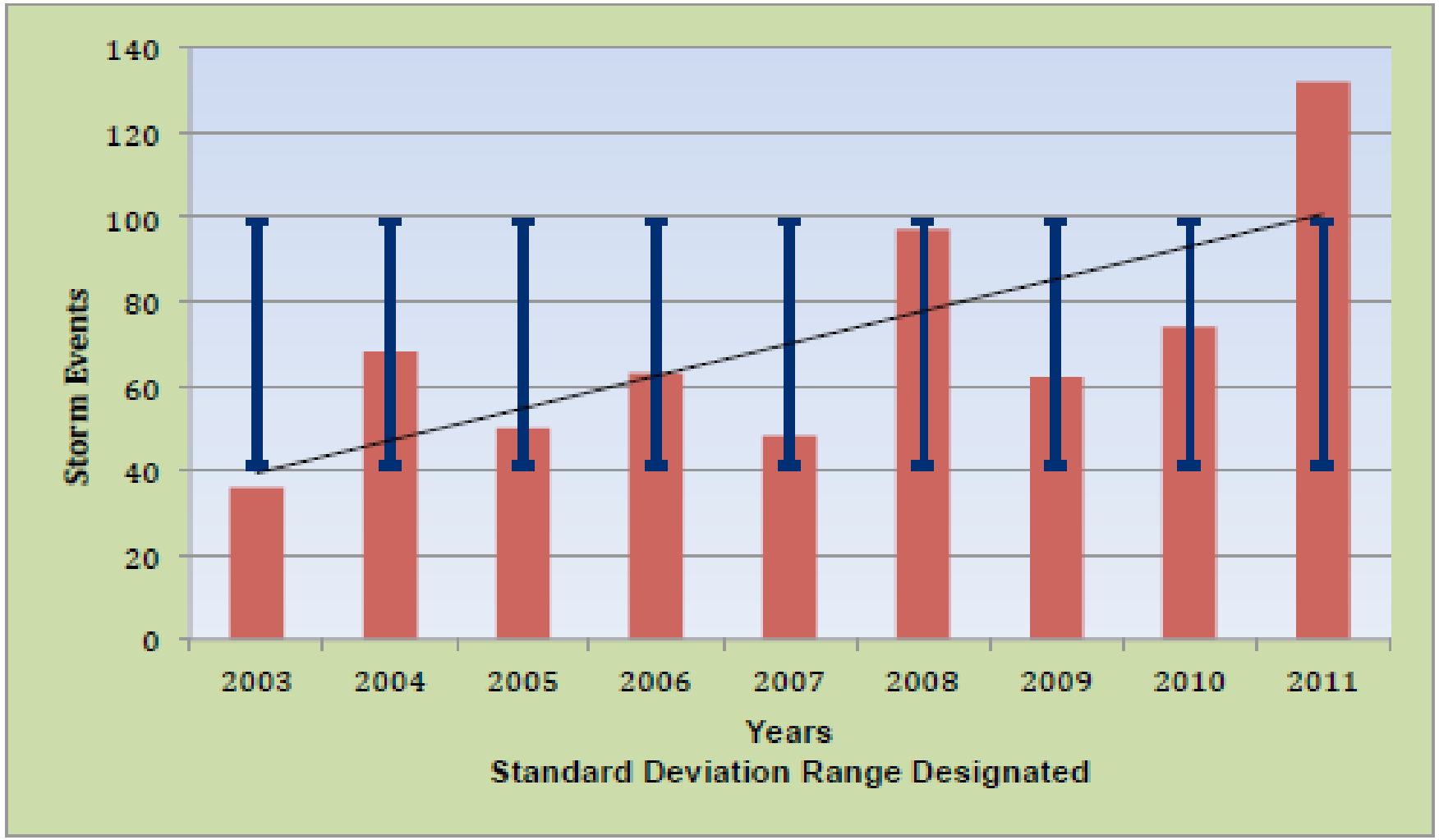
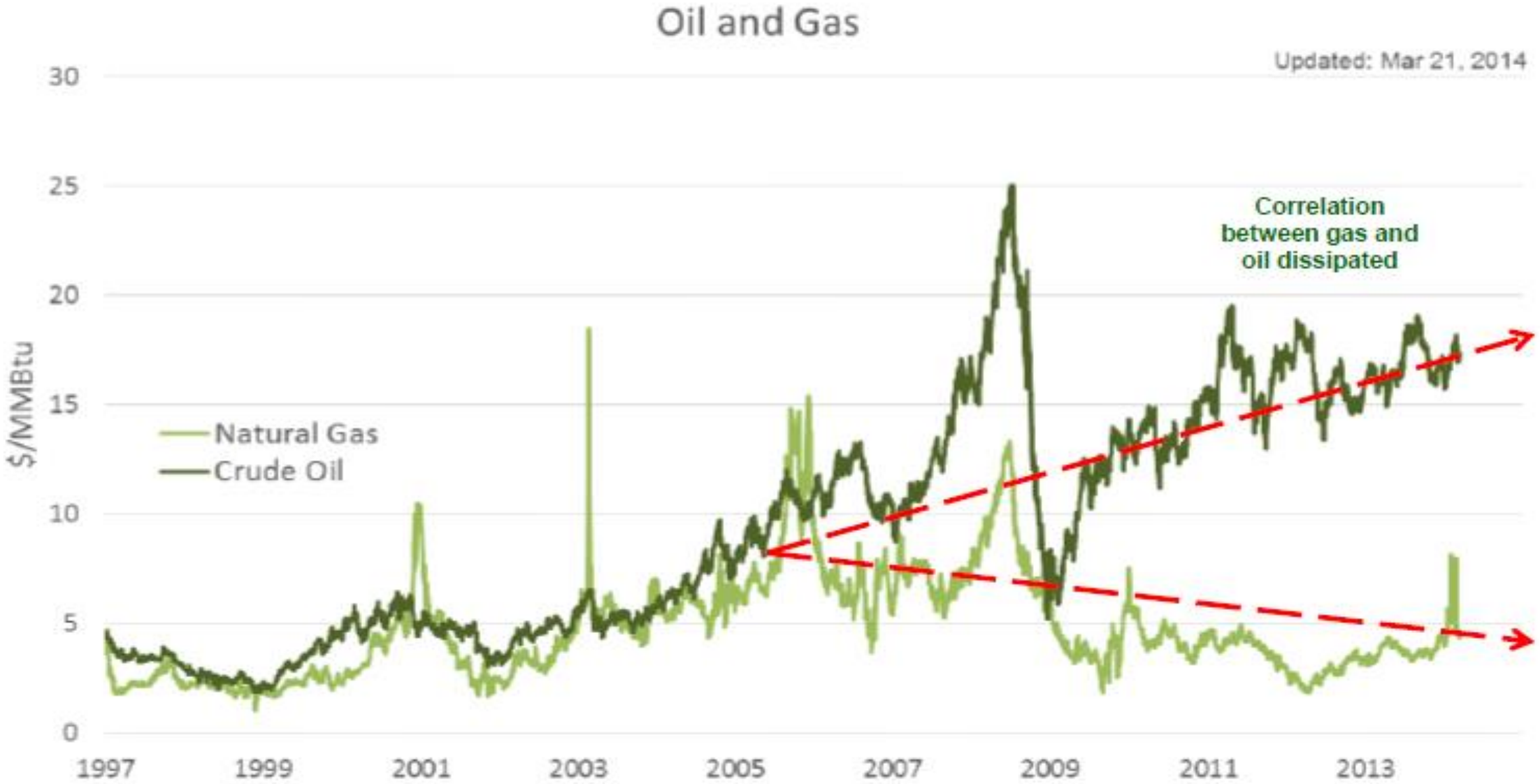
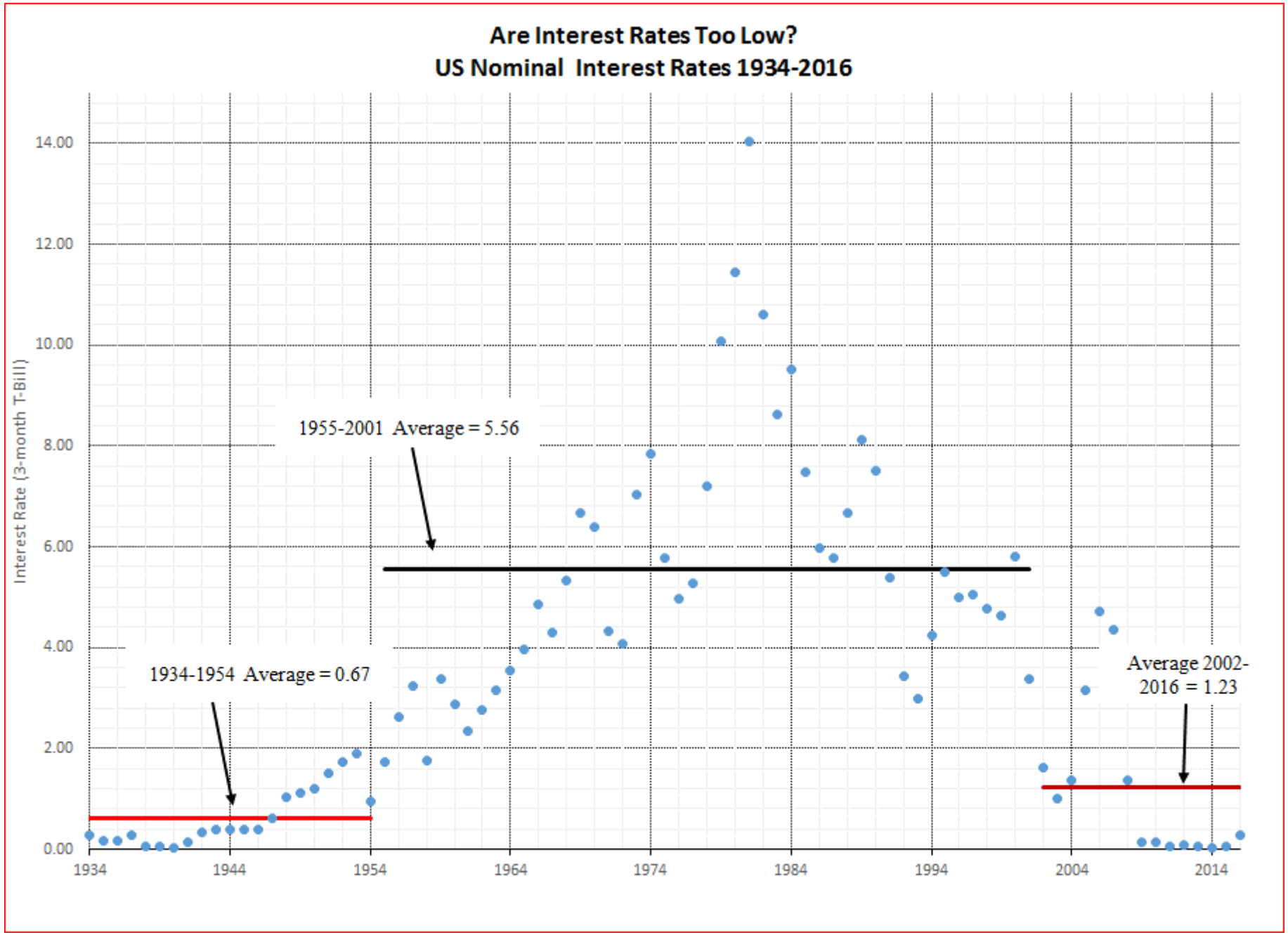

Observed Outages to the Bulk Electric System, 1992-2012
Events
160
140
120
100
80
60
40
20
0
1992
1996
2000
2004
2008
2012
Weather-Related
Non-
Weather
Related
Unclassified
Source: Energy Information Administration

Figure 2.2 EIA Data: Storm Events





The relationship between oil and gas has changed


Are Interest Rates Too Low?
US Nominal Interest Rates 1934-2016
Interest Rate (3-month T-Bill)
14.00
12.00
10.00
8.00
6.00
4.00
2.00
0.00
1934
1944
1954
1964
1974
1984
1994
2004
2014
1955-2001 Average = 5.56
1934-1954 Average = 0.67
Average 2002-2016 = 1.23

Transition in World Views

Old World View

- Universal Access
- Safe-
- Reliable- Deliver those Kwh/MCF
- Affordable- Can buy Kwh/MCF

New World View

- Carbon Constrained world
- Electricity is going to be more expensive- affordability Access
- Attitudinally the role of consumption or conservation- optimize value
- Resilience in face of variability- the new reliable

How does your kitchen rate on the electrical living scale?

Is your kitchen really up-to-date? You may get some surprises, and some good ideas, too, when you check it on the Live Better Electrically "Kitchen Scale" below. There are so many wonderful new ways to put electricity to work in your kitchen today—it makes new electric servants that give you more time and energy for yourself and your family. Decide now which of these electrical work savers you need first. They're easier to buy than you may realize. See your local electrical dealer or utility for the pleasant details.

How many of these electric appliances do you own?	*Circle total here*
____ Dishwasher	24
____ Mixer	23
____ Electric Range	22
____ Juicer	21
____ Refrigerator-Freezer	20
____ Waste Disposer	19
____ Cooking Dish	18
____ Food Blender	17
____ Food Freezer	16
____ Skillet	15
____ Electric Clothes Dryer	14
____ Broiler-Rotisserie	13
____ Work-Surface Lighting	12
____ Air Conditioner	11
____ Toaster	10
____ Full HOUSEPOWER (Adequate Wiring)	9
____ Timer	8
____ Casserole	7
____ Automatic Washer	6
____ Cuunles-Top Cooking Unit	5
____ Food Slicer	4
____ Electric Water Heater	3
____ Deep-Fat Fryer	2
____ Electronic Oven	1
____ Bean Pot	
____ Enough Outlets	
____ Grill	
____ Roll Warmer	
____ Kettle	
____ Ventilating Fan	
____ Built-In Oven	
____ Coffee Maker	
____ Electric Pressure Cooker	

Here's how your kitchen rates!

Just wonderful!

You've arrived! Your kitchen works instead of you. Now you're really living better electrically!

Enjoyable!

You're in clover with electricity doing so much of the work. But look what you're still missing.

Bearable!

You're still tied to those kitchen apron strings; but with more electrical aids, living is so much easier!

Roughing it!

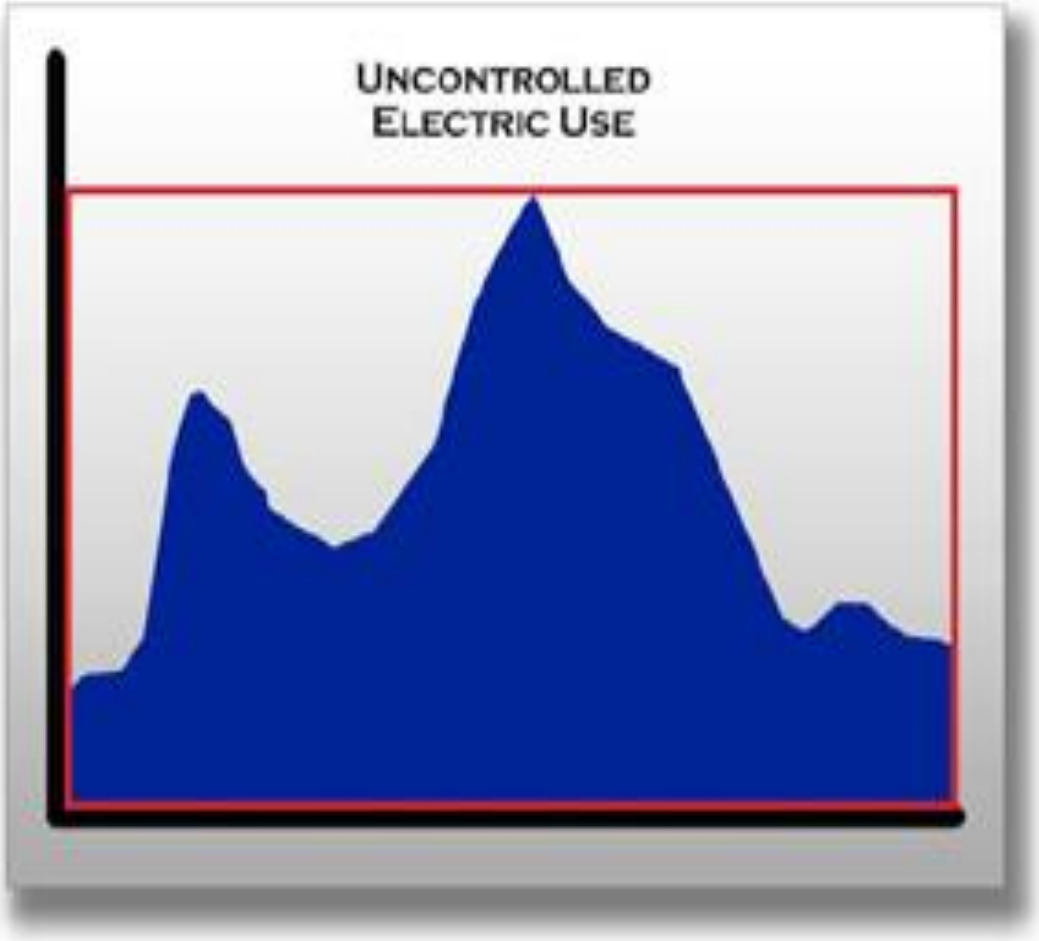
So few appliances to help you. No wonder you're so tired when day's done!

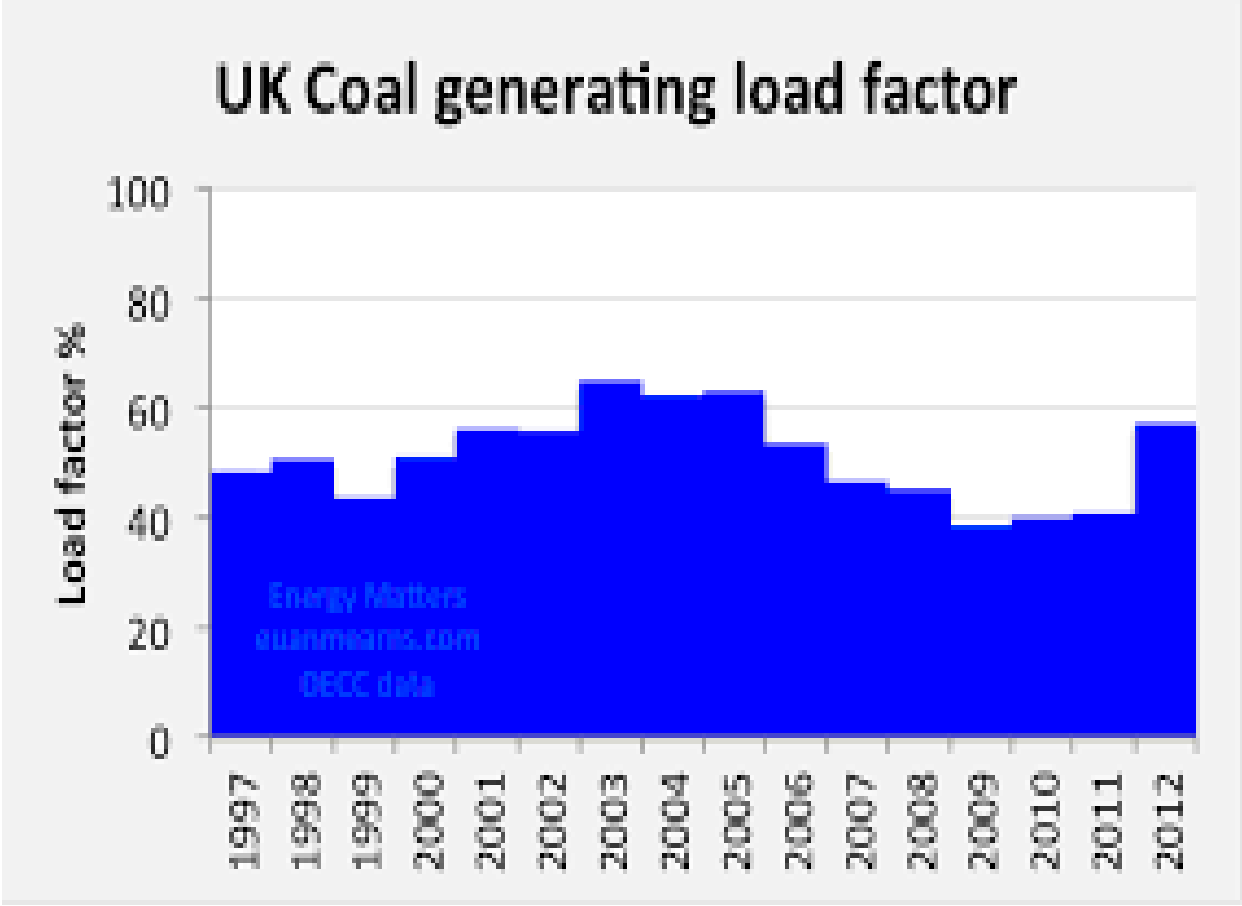
FREE IDEA BOOK
—hundreds of practical hints for making life pleasanter, easier. Ask for "Ideas to Help You Live Better . . . Electrically" at your local electric utility.

LIVE BETTER
...Electrically

LIVE BETTER ELECTRICALLY

Transition from world where we passively meet a customer driven demand to a world where we control Demand





Utility of the Future- Home as Power Plant

- Grid as platform-the Laminar World
- Who is responsible to reliability? I think it is the Disco!
- How to price these services? LMP on distribution grid?
  - ISO doesn’t want to go down to distribution level?
- Home as power plant-Prosumer?
- Utility customer partnerships
  - Utility behind the meter
    - Callable resources
    - Dedicated resources
    - Emergency resources

The Home as Power Plant

- Investments in DG- Solar, Natural Gas, Propane, Wind
- Investments in Smart Appliances
- Investments in Energy Management Systems
- Investment in Battery Systems
- Investment in EV-V2G
- Investments in Home Design- Passive solar, tightening envelope

Implications for Regulation

- Core and Non-Core Services?
- Open access and Imputation?
- Transactive services and menu of contracts?
- Outcome focused Regulation
  - Performance or Incentive Regulation
  - Metrics for Core and Non-Core
  - Performance Measures
    - Degree of Transactive Services
    - Range of Services
    - Values Customer Receives

What Are the Questions Regulators and Industry Must Face?

- Is there a threat to the business as usual model of a utility?
- Is it disintermediation or refocused intermediation in the future?
- What is the role of transactive markets and how will we regulate it?
- Home as power plant is the next frontier for competition.