Changes in Electricity Demand
Historical, Current, Future

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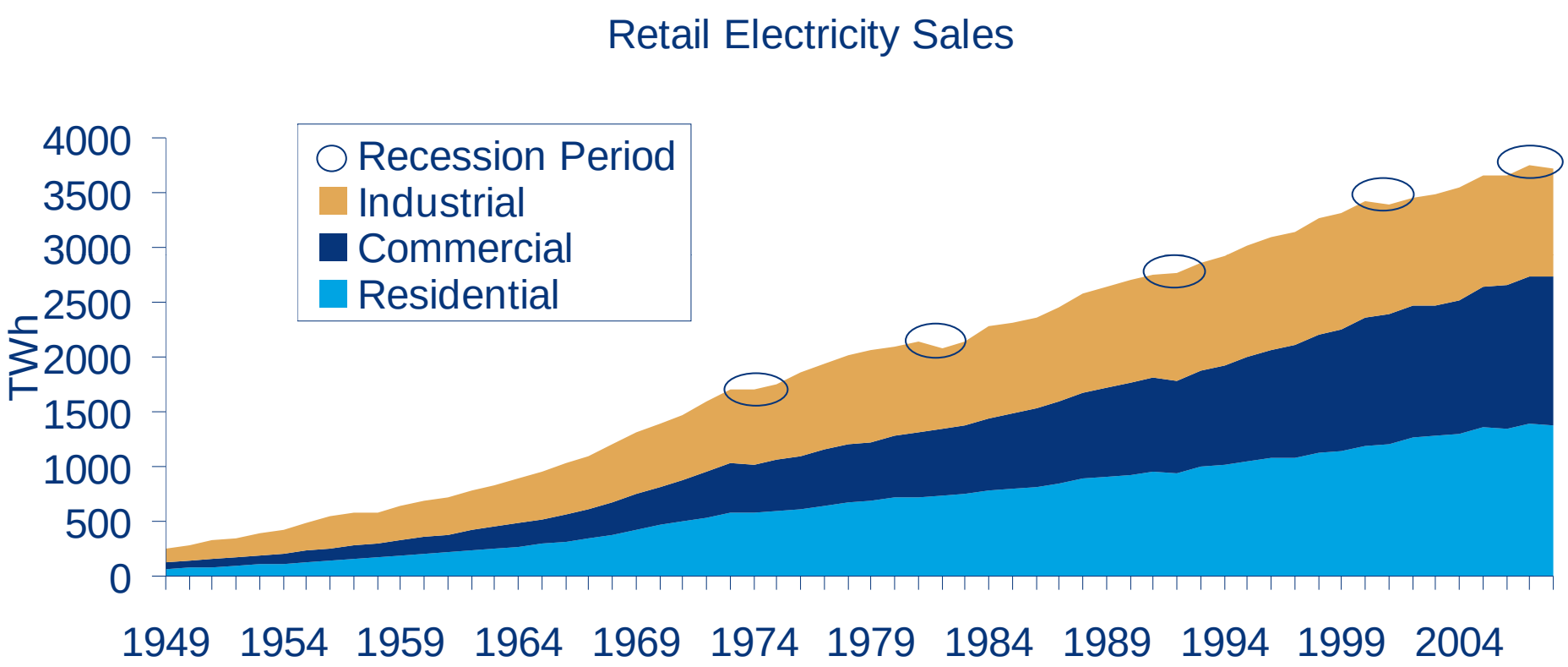
LSU Center for Energy Studies Annual Energy Summit

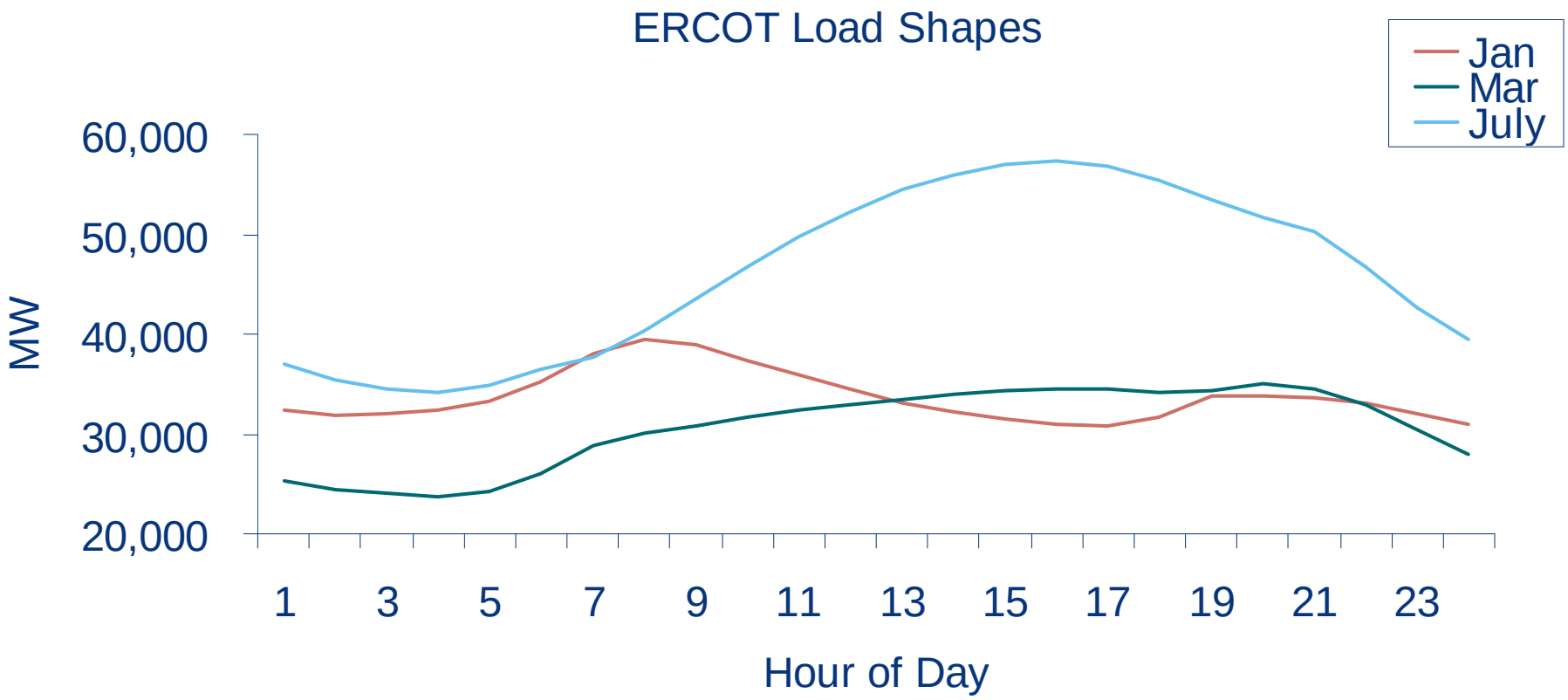
Agenda

- Introduction
- Electric Power Demand Growth
- Recent Demand Destruction
- Future Electricity Demand Drivers
- International Experience and the Future

Historical U.S. Power Sales Growth



Hourly Power Load Shapes Vary by Month



Sources of U.S. Power Demand Growth

GDP Drives electricity consumption, but only partially

Population Growth, Air Conditioning Penetration, etc…

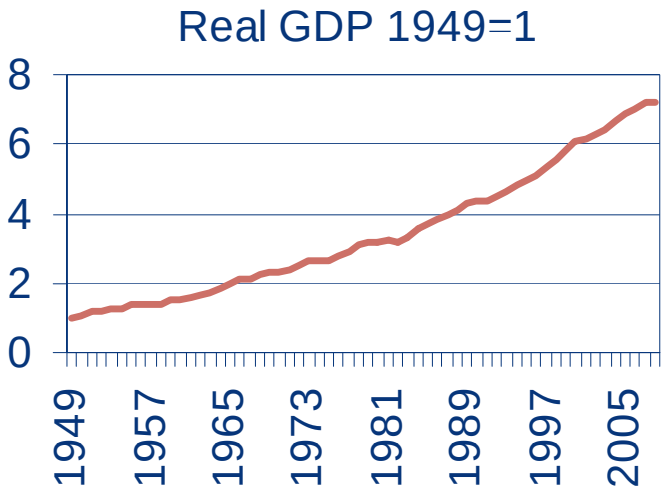
Electric Intensity per $GDP

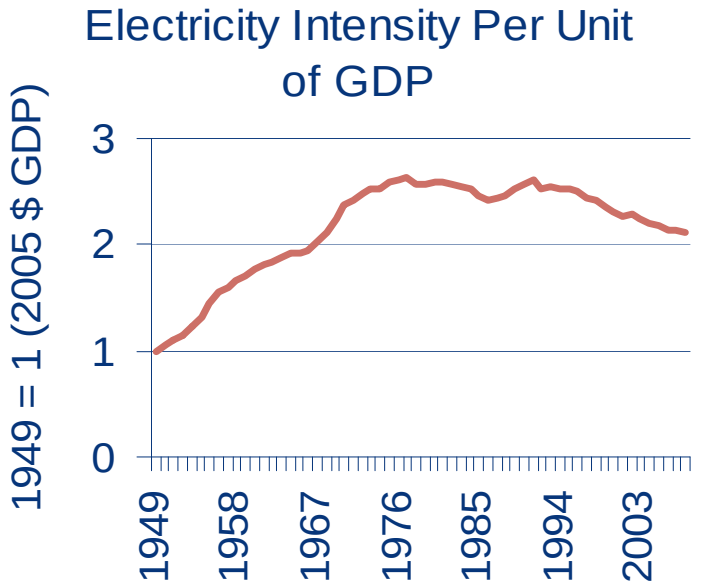
- history can be subdivided into separate phases:
  - rising first, hitting a plateau and then declining over the past 15 years
- some of the rise was caused by rural electrification

- Transition from manufacturing economy to services causing the decline now

New Technologies

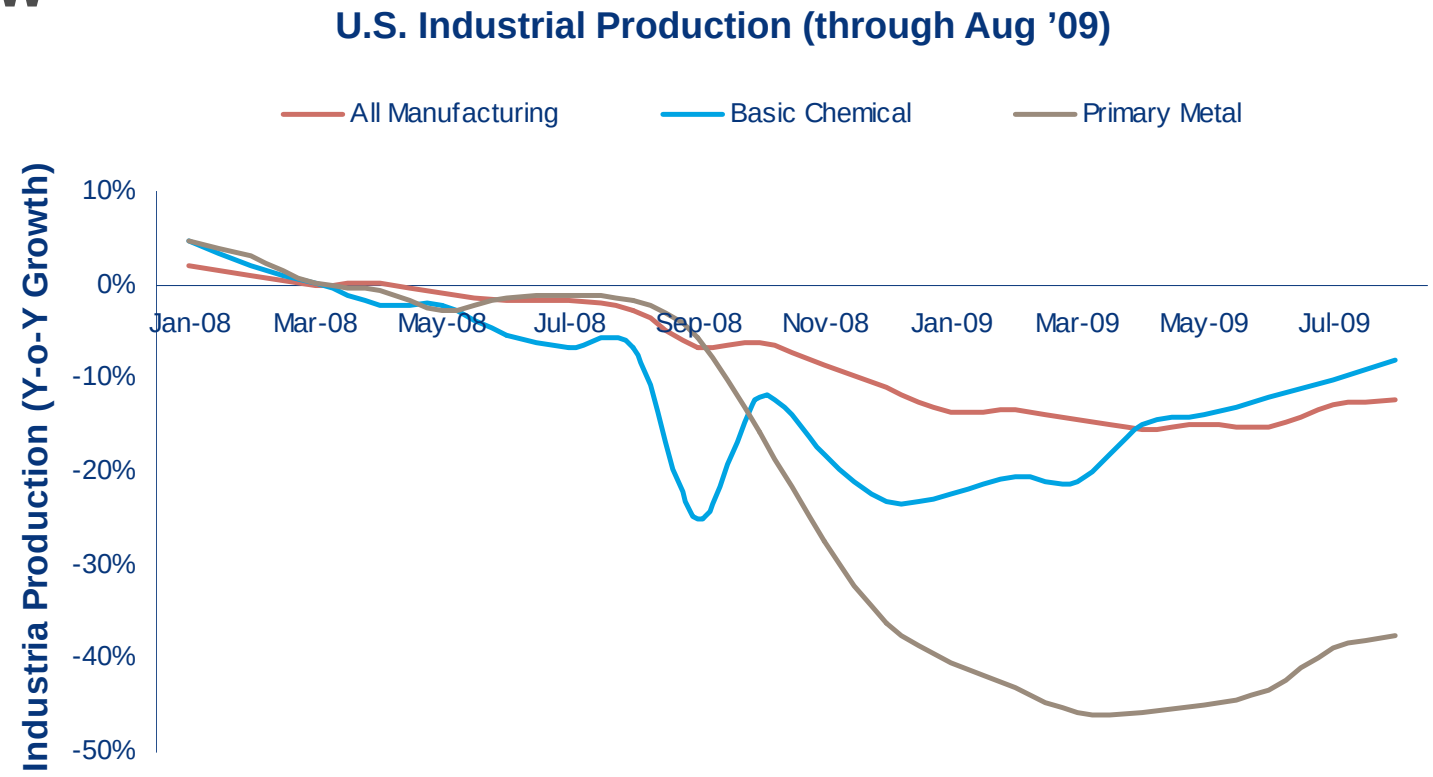
- and more of them that use power





The Recession's Impact on Industrial Production

- Manufacturing crash 2008-09
- Global synchronized recession
- Are we now in a recovery phase?
  - V, U, or W

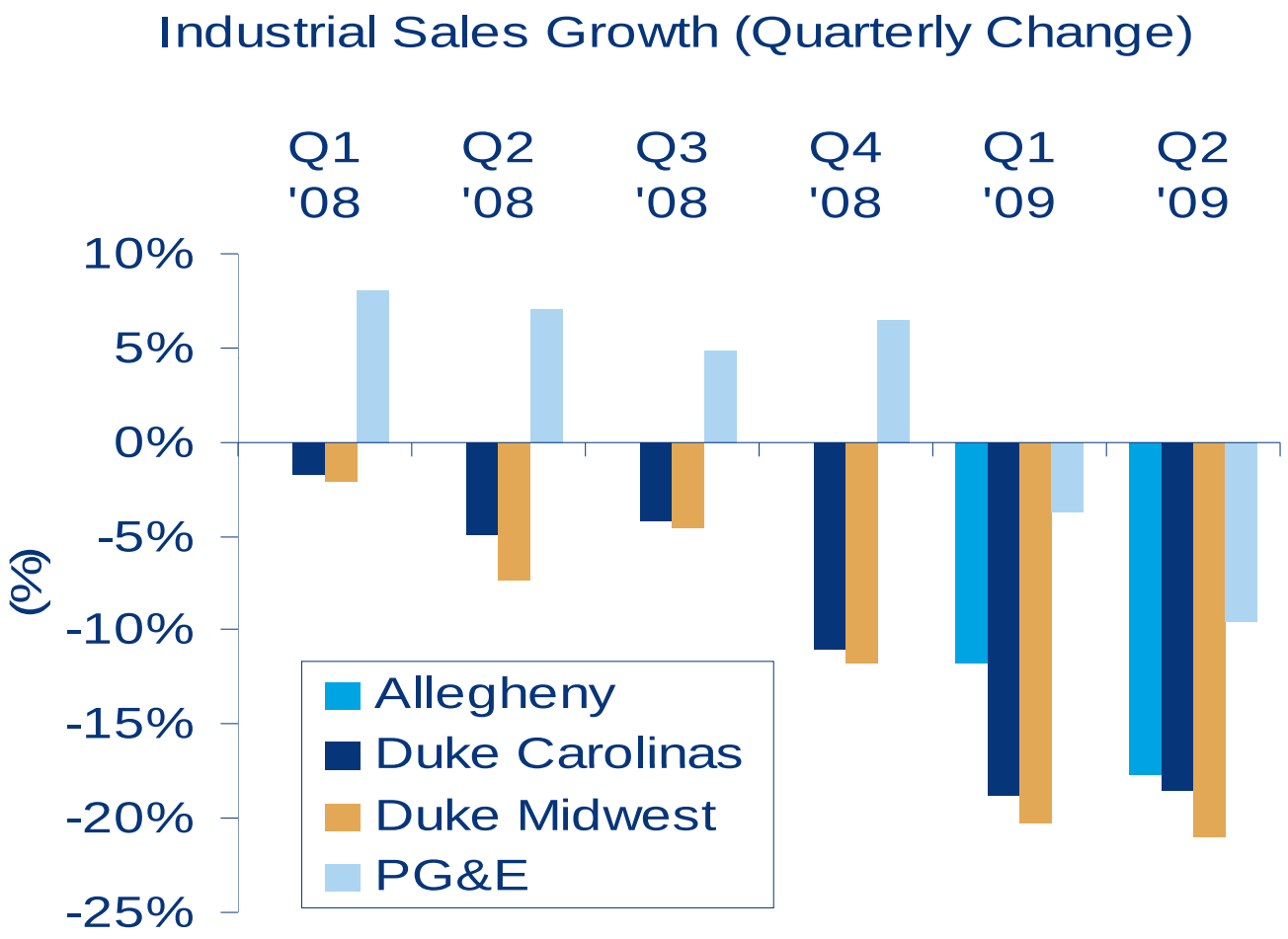


Recession Effect on Power Consumption

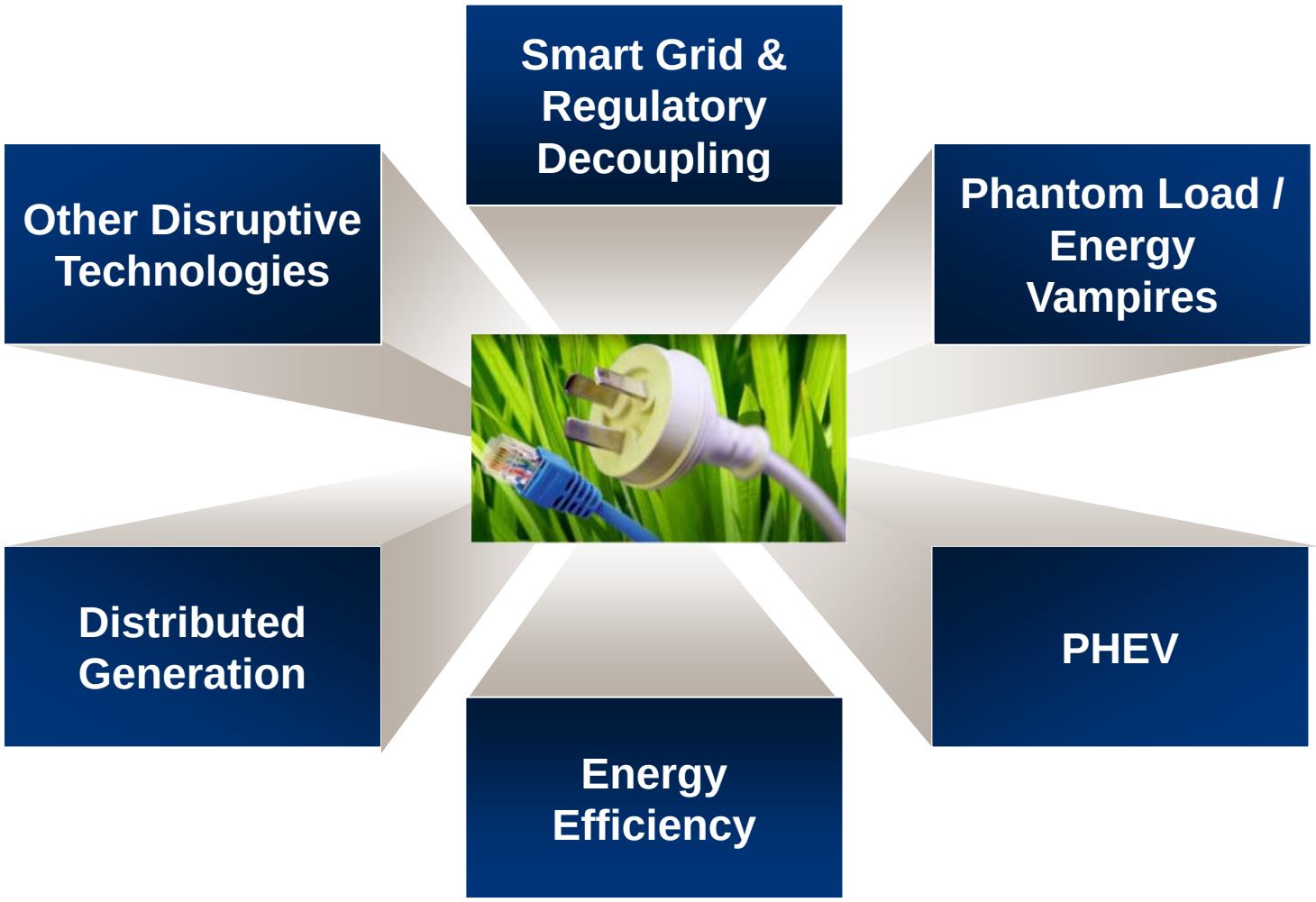
The effect on recent power demand has been severe.

Industrial sales are down by as much as 20% in Q1 and Q2 in several markets

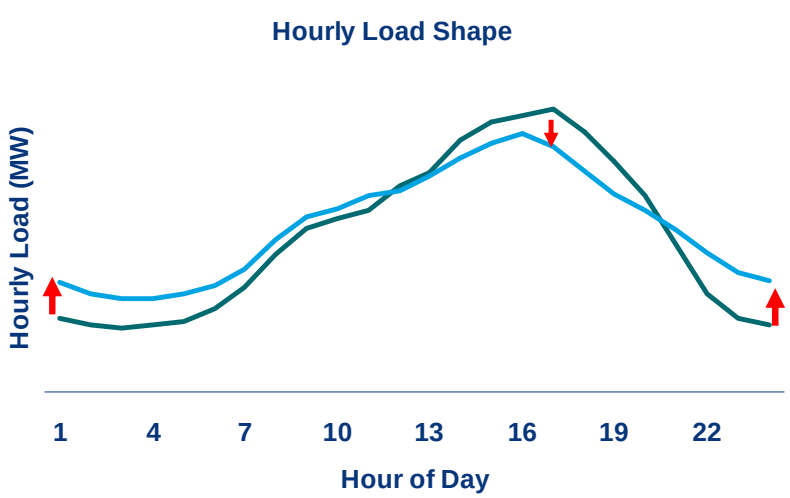
Signs of a contraction were actually evident in 2008 – a potential leading indicator

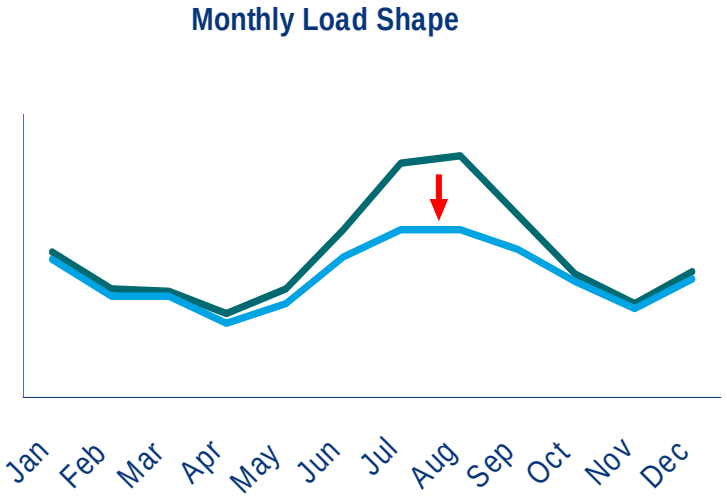


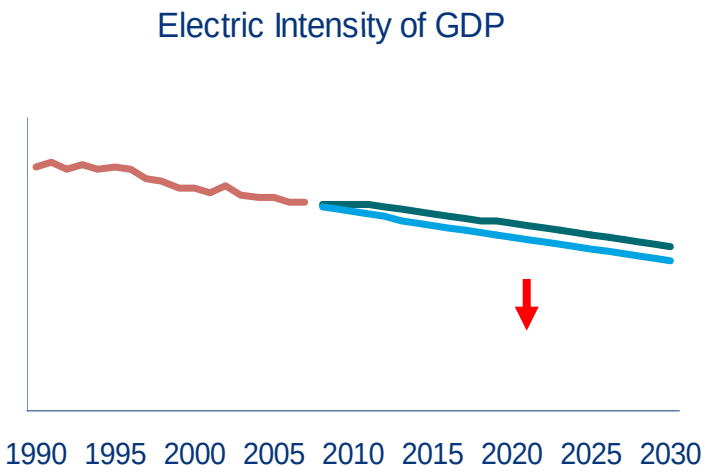
Future Electricity Demand Drivers

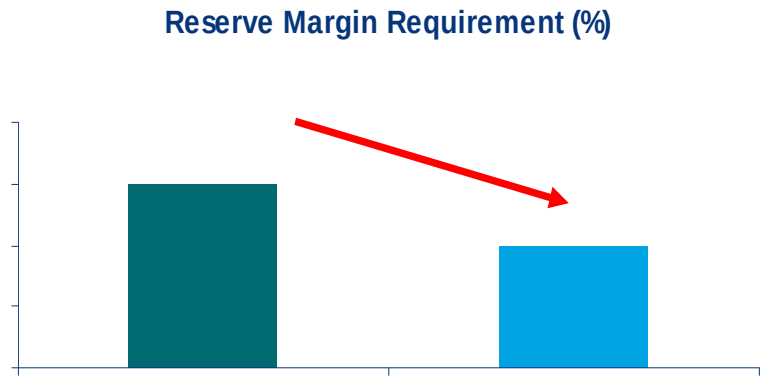


Possible Smart Grid Potential Impact on: Electricity Fundamentals

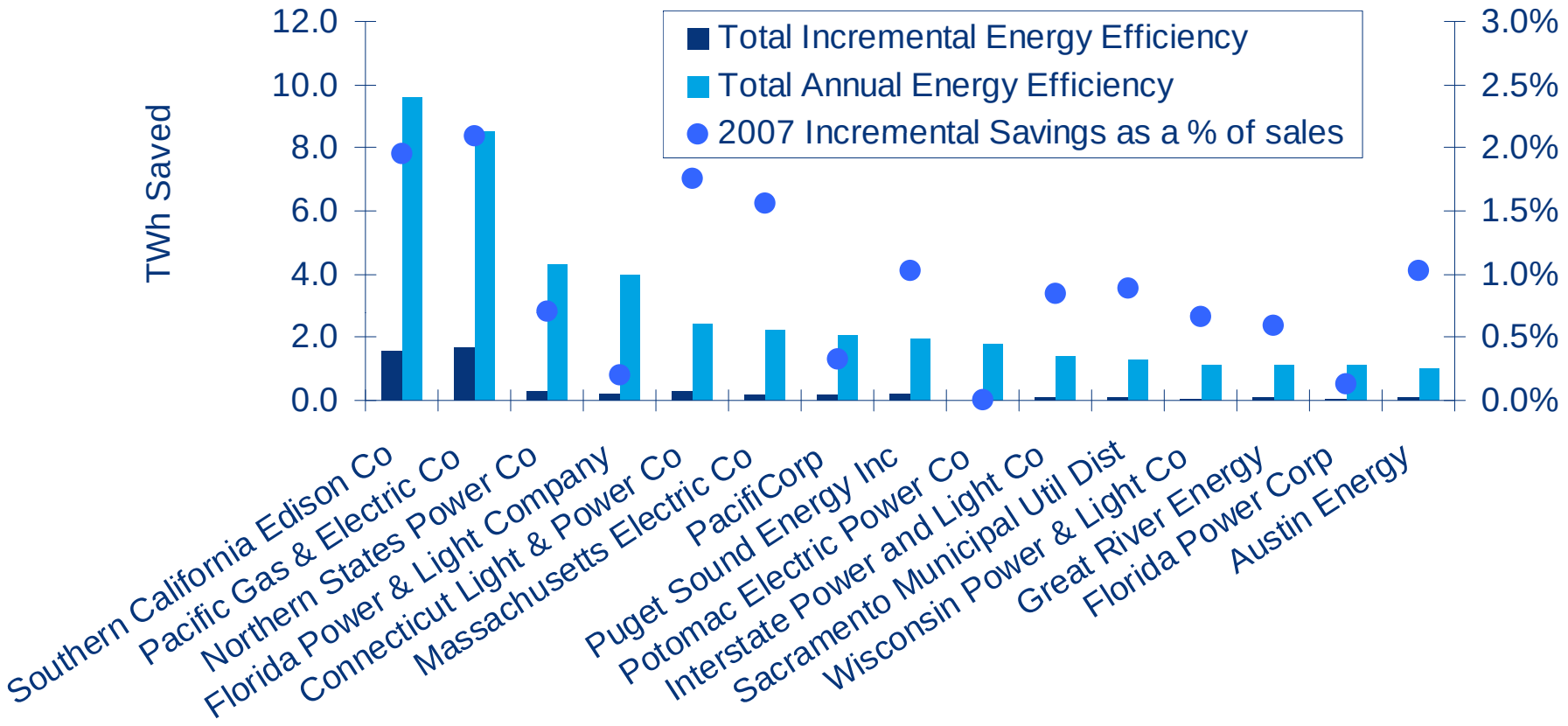








Historical Energy Efficiency (EE)

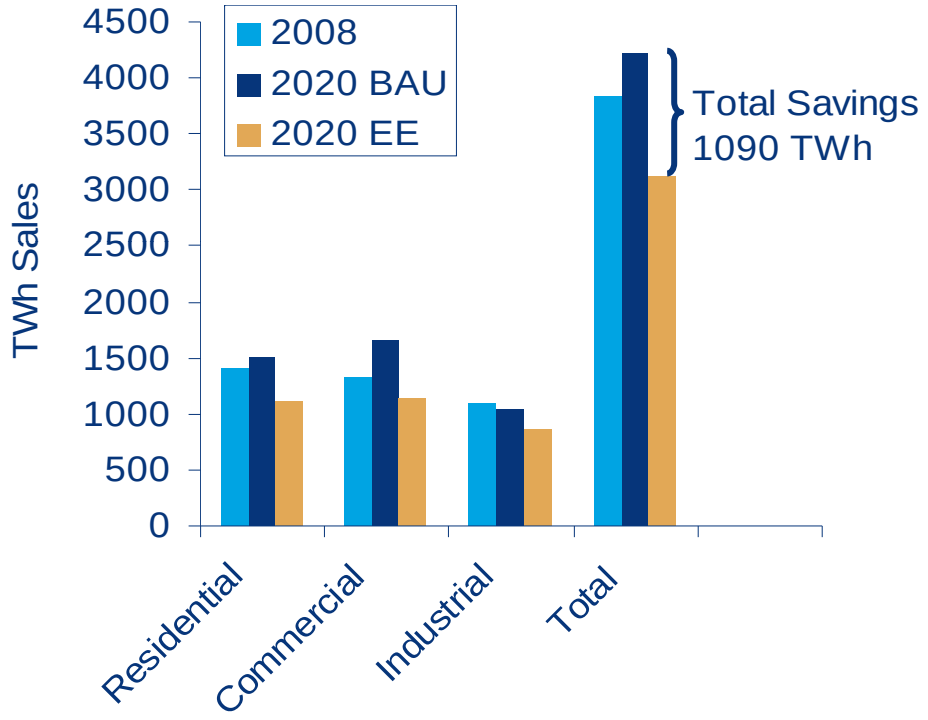


- **Total annual energy efficiency represents the cumulative total effect of past and current programs.**
- **California programs have had the most impact both for 2007 and cumulatively.**

Source: EIA 861

What is the Potential Future for U.S. Energy Efficiency?

- **Study projects the most potential for power in the residential and commercial sectors**
- **Potential TWH saved were based on programs that were NPV positive (economic for their own sake)**
- **Barriers to over come:**
- **1 substantial up front cost to be amortized over a long period**
- **2 high number of fragmented sites requiring new investment**
- **3 utility and regulator willingness to uncouple rates from sales (disconnect sales and earning)**
- **Results:**
  - 2020 EE Case sees a reduction from 2008 consumption by 700 TWh or 1090 TWh from the BAU case



Source: Unlocking Energy Efficiency in the U.S. Economy, McKinsey July 2009

Will Plug-in Hybrid Electric Vehicles (PHEV) Drive Demand?

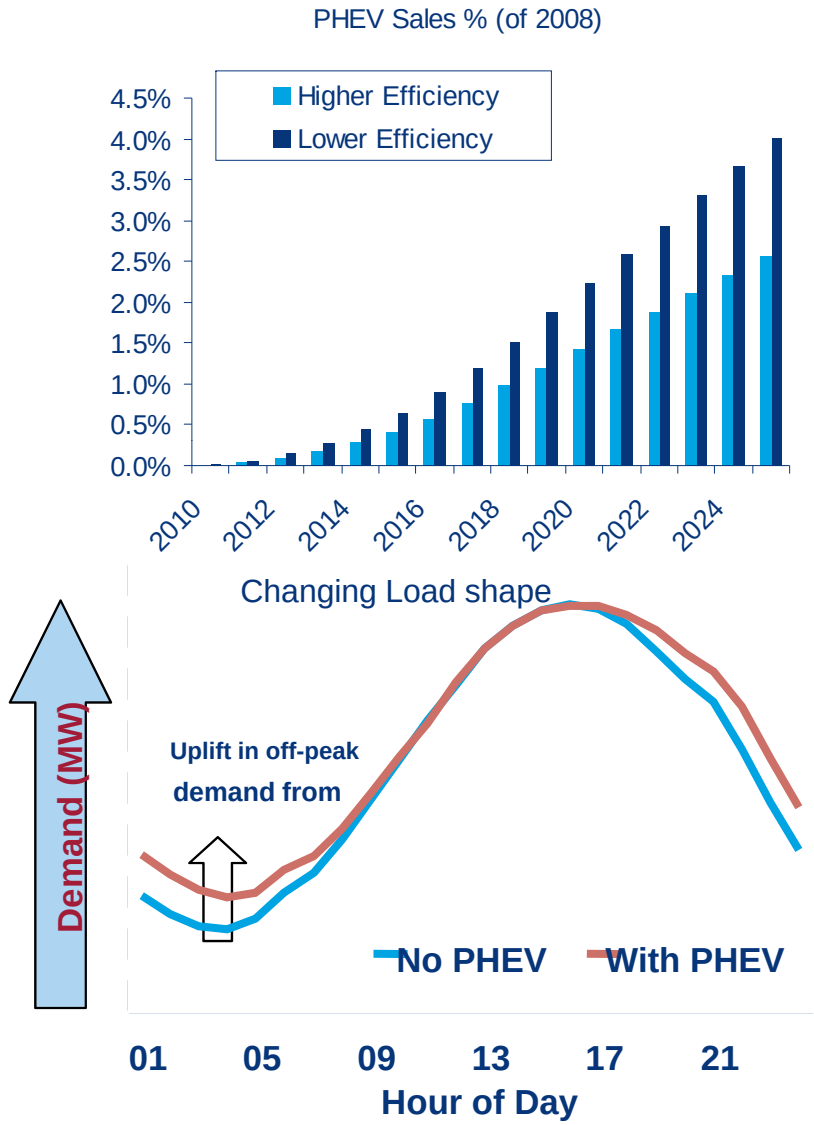
Assumptions

- Initial PHEV sales growth rate is 4% p.a. of total LDV fleet - 65m vehicles by 2025
- PHEV-40 vehicle (200 trips per Year)
- Ten year life cycle
- Efficiency Assumption range: 3.2 – 5 miles/kWh

Results

- U.S. Consumption in 2008: 4000 TWh
- PHEV Consumption in 2025: 100 – 160 TWh (2.5% - 4% of 2008 U.S. Sales)
- Significant uncertainty in changes to load shape

More off peak consumption = more coal and CO2

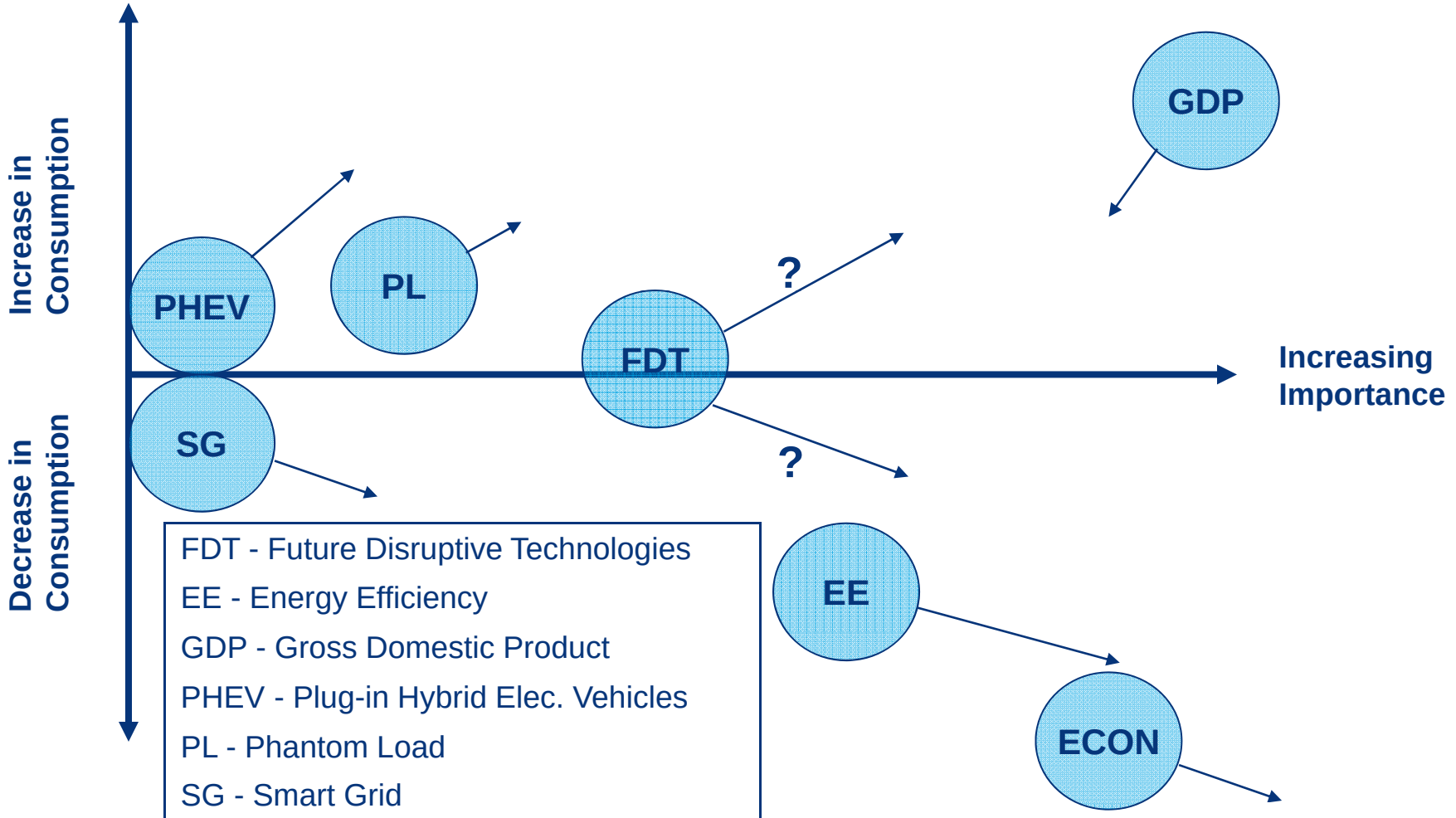


"Phantom Load" and "Energy Vampires": Do these completely offset energy efficiency gains?

- Phantom Load represents electricity usage by appliances when they are turned off – consumed during standby mode.
- Many studies and sources claim that as much as 20% of residential electricity load is due to this.
- Wide range of estimates, but watch the baseline measure being compared to:
  - "75% of the electricity used to power home electronics is consumed while the products are turned off. USDOE
- Another Big Uncertainty: how much could this change in the future?
- <u>Much more work needs to be done here</u>

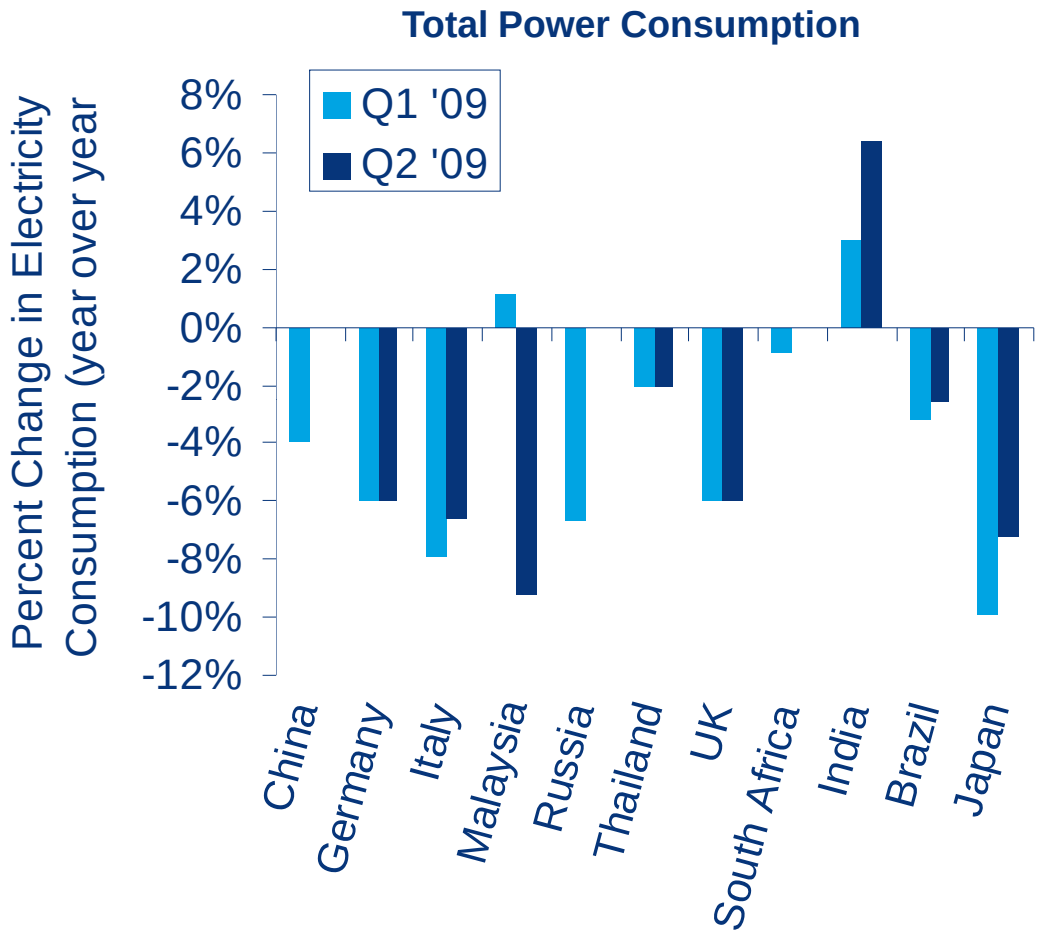
	Percent of Total Sales
EU Study 2005	2.0%
UK Energy Review 2006	8.0%
US Energystar.gov (CES 2009)	2.5%

Recap: Changes in Future electricity demand: relative importance



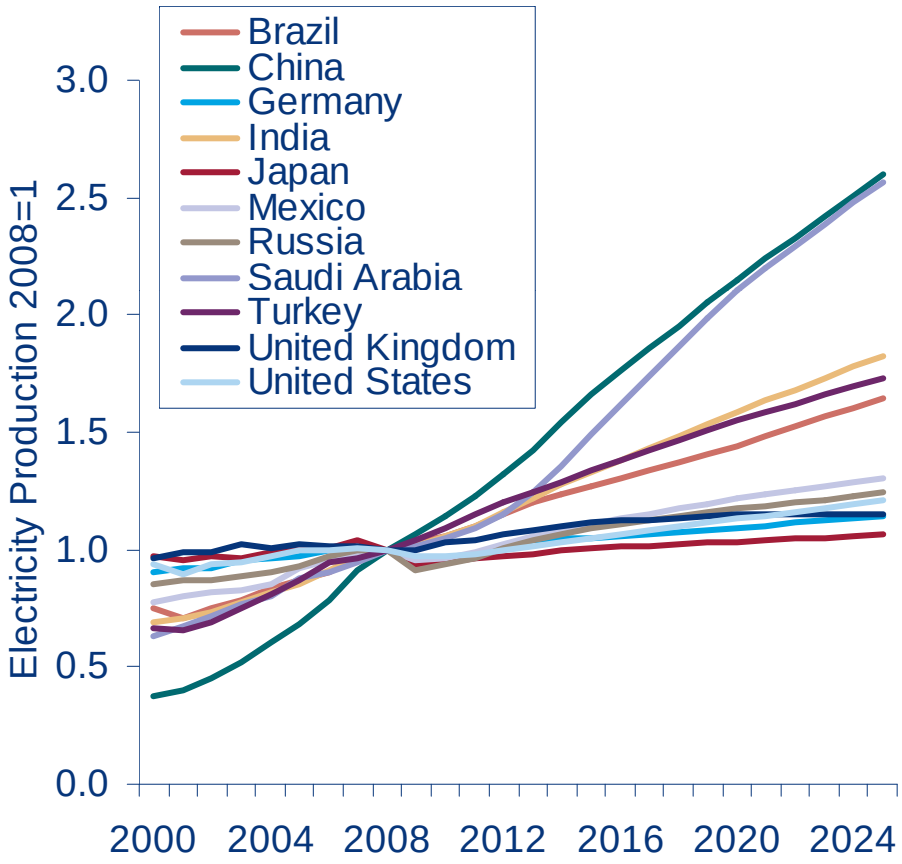
International Power Consumption: First Half 2009

- Broadly speaking, Q1 and Q2 electricity sales were disproportionately driven by massive contractions in manufacturing and industrial sales.
- In Japan, industrial power sales were down 21% in Q1 and 18% in Q2
- Results from India were strongly positive
- China data was from official reports (more recent data is not available)

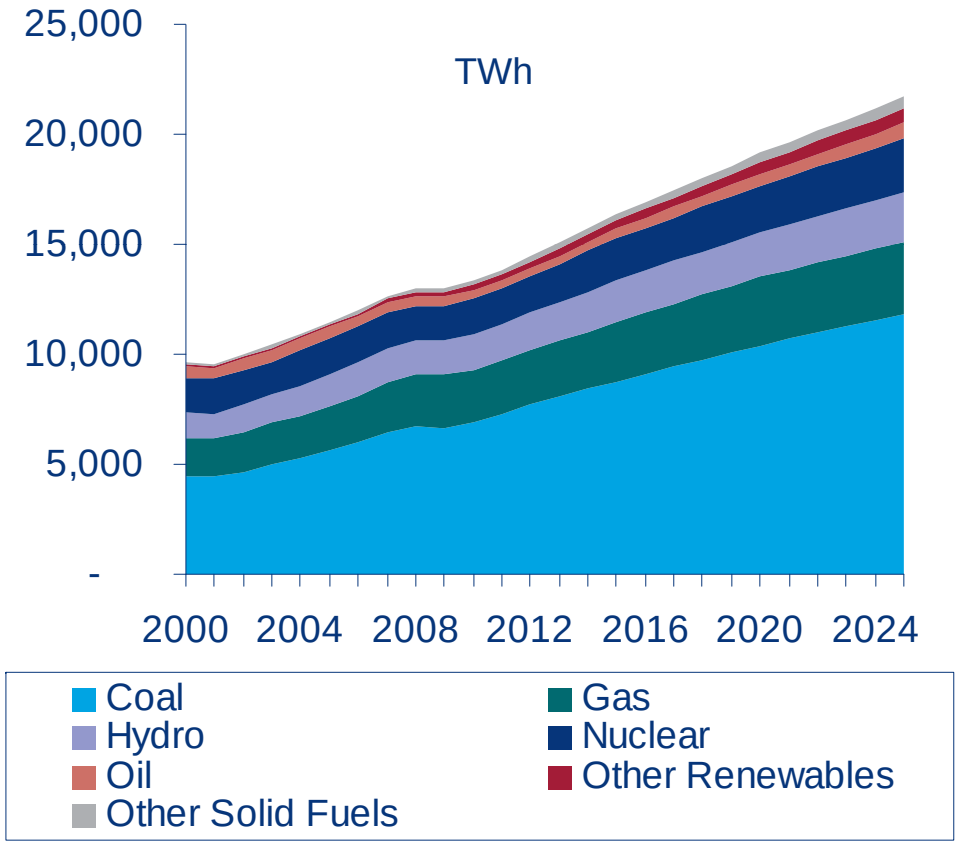


Projections in Power Production (proxy for Consumption) in Selected Countries

Growth Rates 2008 = 1



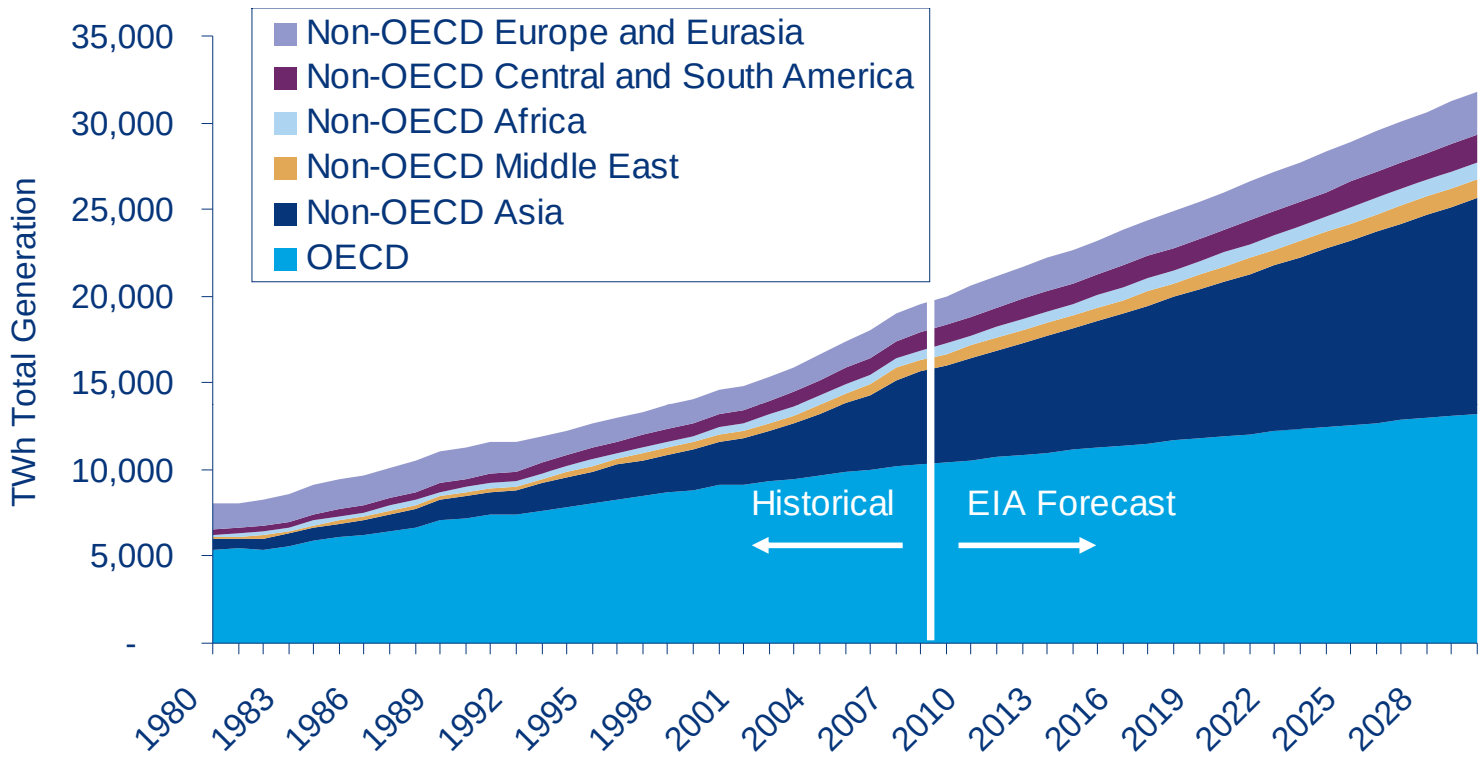
Coal Share grows from: 47% to 55% through 2025, mainly due to China



Source: Wood Mackenzie Energy Markets

Total World Electricity Production (proxy for Consumption)

- **Total generation growth expected to slow to 2.2% through 2030 down from 3.2% since 1980**
- **Non-OECD growth rate is triple the OECD**
- **Non-OECD generation to overtake OECD by 2014 and reach: 18,560 TWh by 2030**



	OECD	Non-OECD Asia	Non-OECD Middle East	Non-OECD Africa	Non-OECD Central and South America	Non-OECD Europe and Eurasia	Non- OECD Total	World Total
Total Growth	1.8%	6.3%	5.1%	3.4%	3.3%	1.0%	4.0%	2.8%
80 -2008	2.3%	8.2%	7.4%	4.0%	4.4%	0.5%	4.6%	3.2%
09 - 2030	1.1%	3.9%	2.2%	2.5%	2.0%	1.8%	3.2%	2.2%

Conclusions

- **Never been a more "interesting" time to forecast electricity demand**
- **New technologies are both increasing and decreasing demand**
  - Competing forces: pushing demand higher and lower
- **Future structural changes in economy will impact demand growth and load shape but these are uncertain**
- **Unprecedented worldwide decline shows the magnitude of the recession**
  - Industrial load hardest hit
  - Latest data indicates the worst is over(?)
- **Beyond the recession: electricity consumption expected to grow**
  - …especially in non-OECD countries (rate of over 3%)
  - But both OECD and Non-OECD growth is projected to be lower than in the previous 25 years

Contacts

- George Given leads Wood Mackenzie's Global Power Research practice. Mr. Given has over 15 years of experience serving electric power, natural gas, oil, and coal companies. His current focus is managing and developing the strategic direction of power research across Wood Mackenzie's global operations. As a power and fuels market consultant, Mr. Given has advised financial institutions, utilities, independent power producers, and integrated energy companies on investment opportunities and risk factors, provided independent market opinions (lenders' reports) in nearly 100 asset transactions, and provided strategic analysis of energy market trends across North America, Europe and Asia using fundamental-based, integrated energy-environmental modeling techniques.

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