Americans for a Clean Energy Grid

Tulane University

Entergy

Electricity Economics: is Clean Energy *also* Affordable Energy?

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Entergy Corporation

Scope of Operations

Entergy's Businesses

- 30,000 MW electric generating capacity
- One of the nation's leading nuclear generators
- 2.8 million utility customers
- More than $10 billion annual revenues
- ≈ 14,000 employees

Regulated Utilities

- 6 vertically-integrated public utilities (5 regulators)
- 4 contiguous states – AR, LA, MS, and TX
- ≈ 22,000 MW generating capacity
- ≈ 15,400 miles of high-voltage transmission lines

Entergy Wholesale Commodities

- 6 nuclear units owned at 5 sites (5,011 MW)[1]
- 2 gas, 1 gas / oil facilities (1,340 MW)
- 2 wind facilities (80 MW)
- 2 coal facilities (181 MW)
- 1 nuclear plant managed (800 MW)
- District energy systems[2]

Entergy's Footprint

1 Entergy plans to close and decommission the Vermont Yankee plant at the end of its current operating cycle in 4Q14.

2 Entergy Solutions District Energy was sold in 4Q13.

Average Electricity Rates

- So how do the states that Entergy's utilities serve stack up with respect to electricity rates?
- In general, we operate in states with fairly low electric rates… some contributing factors include lower natural gas prices and less environmental capital spending
- Other lower-cost states tend to have a higher percentage of legacy nuclear, coal, and hydro
- Higher cost states such as in the Northeast and California tend to have more expensive infrastructure costs, higher labor costs and taxes, and various regulatory policies that increase costs for consumers

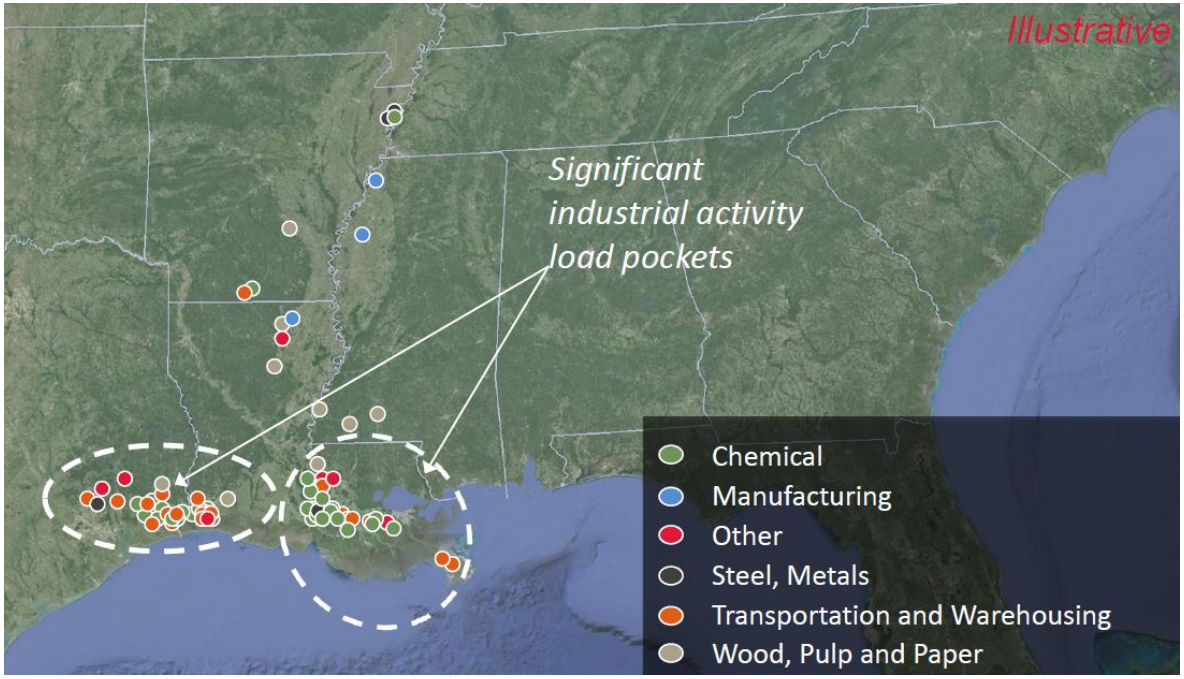
2013 Average Rates by State and by Customer Type

Rank	State	Residential	Commercial	Industrial	All Sectors
1	Washington	8.67	7.76	4.22	7.06
2	Kentucky	9.71	8.50	5.40	7.54
3	Wyoming	10.18	8.60	6.41	7.55
4	Idaho	9.37	7.40	6.12	7.61
5	Oklahoma	9.62	7.71	5.34	7.81
6	**Arkansas**	**9.51**	**7.98**	**5.88**	**7.82**
7	West Virginia	9.52	8.16	6.20	7.91
8	Illinois	10.25	7.88	5.73	7.99
9	**Louisiana**	**9.39**	**8.94**	**5.89**	**8.00**
10	Iowa	11.15	8.47	5.66	8.12
⋮	⋮	⋮	⋮	⋮	⋮
17	**Texas**	**11.37**	**8.03**	**5.93**	**8.77**
21	Alabama	11.27	10.50	5.99	9.02
23	South Carolina	11.82	9.82	5.92	9.14
24	**Mississippi**	**10.82**	**10.21**	**6.45**	**9.15**
26	North Carolina	10.91	8.73	6.34	9.18
27	Tennessee	10.04	10.01	6.44	9.22
30	Georgia	11.24	9.84	6.11	9.53
	U.S. Total	**12.12**	**10.29**	**6.82**	**10.08**
35	Florida	11.36	9.49	7.68	10.30

Source: U.S. Dept. of Energy, EIA 826

Gulf Coast Industrial Activity

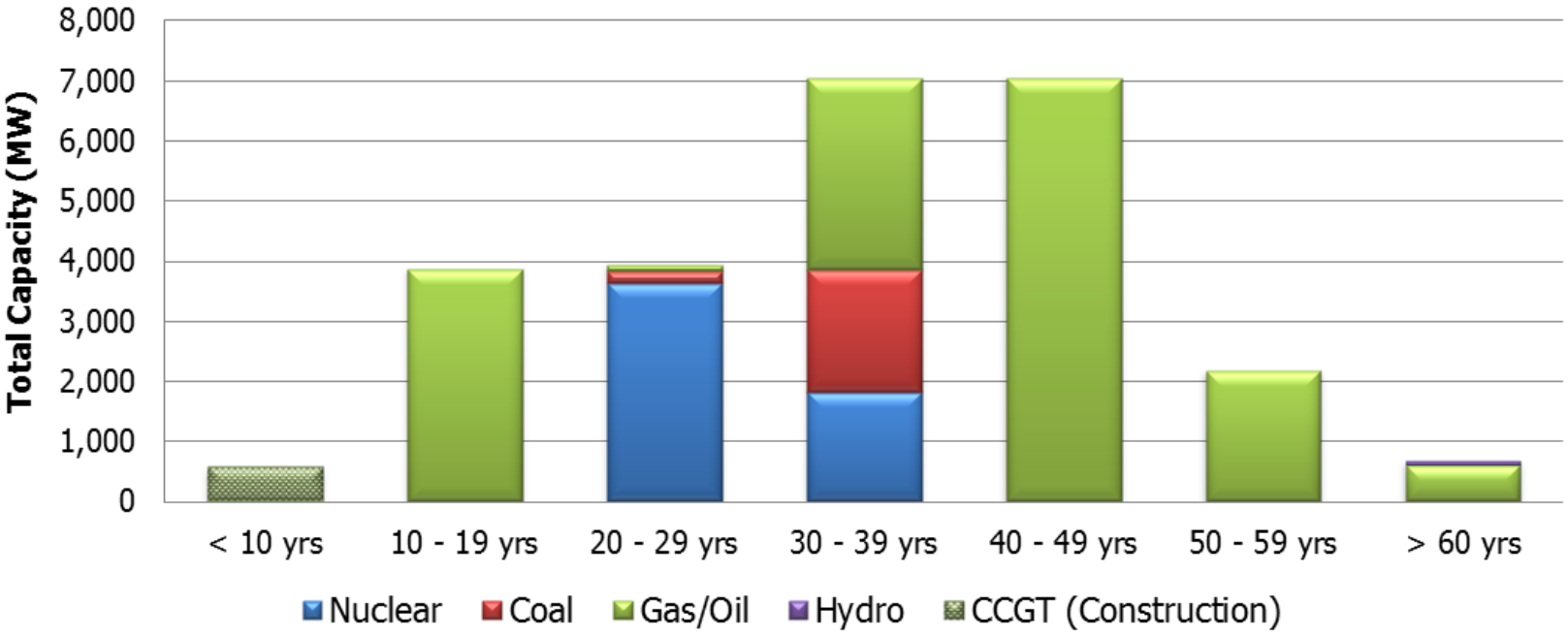
- Lower / more stable natural gas prices
- Infrastructure (ports, waterways, pipelines, rail, transmission lines)
- Raw material suppliers and end-use customers
- Skilled labor force
- State economic development incentives
- Competitive electric rates



Source: Entergy's 2014 Analyst Day presentation

Entergy's Existing Utility Fleet

- Like many utilities, Entergy's generation resources are aging (MW-weighted average age is ≈ 37 years)
- Coal and nuclear units were constructed between 30 – 40 years ago
- Projected unit deactivations over the next 20 years will require significant capital investment to replace
- Older units that will continue in service will require capital investment to ensure reliable operations and to comply with environmental rules



Source: www.entergy.com, Operations Information, Generation Portfolio

Entergy's Recent Fuel Mix / Costs

- Nuclear and purchases fairly steady with gas generation up and coal down
- Gas and purchase costs have declined significantly since 2008, whereas nuclear and coal have seen increases
- Overall, fuel and purchased energy costs across Entergy's six utilities have been very stable over the past five years

% of Total Energy

Source	2013	2012	2011	2010	2009	2008
Gas & Oil	25.9%	26.8%	25.3%	22.5%	19.7%	22.0%
Coal	11.6%	11.5%	12.5%	13.2%	13.7%	14.0%
Nuclear	33.0%	32.6%	33.7%	35.7%	37.9%	34.0%
Hydro	0.1%	0.1%	0.1%	0.1%	0.2%	0.2%
Purchases	29.3%	29.1%	28.3%	28.6%	28.5%	29.9%
Total	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**

Average Cost (¢/kWh)

Source	2013	2012	2011	2010	2009	2008
Gas & Oil	4.1	3.2	4.9	5.4	5.6	10.3
Coal	2.7	2.6	2.3	2.0	2.0	2.1
Nuclear	0.9	0.9	0.8	0.8	0.7	0.6
Purchases	4.3	3.6	4.6	5.3	5.3	7.9
Total	**3.0**	**2.5**	**3.1**	**3.3**	**3.1**	**5.1**

Source: Entergy's Annual Investor Guide

Supply Investments Since 2005

- Acquisitions
  - Perryville CCGT and CT (676 MW)
  - Calcasieu CT (302 MW)
  - Ouachita CCGT (731 MW)
  - Acadia Power Block 2 CCGT (545 MW)
  - Attala CCGT (460 MW)
  - Hinds CCGT (463 MW)
  - Hot Springs CCGT (615 MW)
- Self-Build Projects
  - Waterford 4 CT Blackstart (33 MW)
  - Ninemile 6 CCGT (550 MW)
- Nuclear Projects
  - Waterford 3 Steam Generators Replacement (1,159 MW)
  - Grand Gulf Extended Power Uprate (+ 178 MW)
- Long-Term PPAs
  - Oxy, Calpine, Rain CII Carbon, Agrilectric, etc.

Waterford 3 Steam Generators Replacement Project

Ninemile 6 Construction

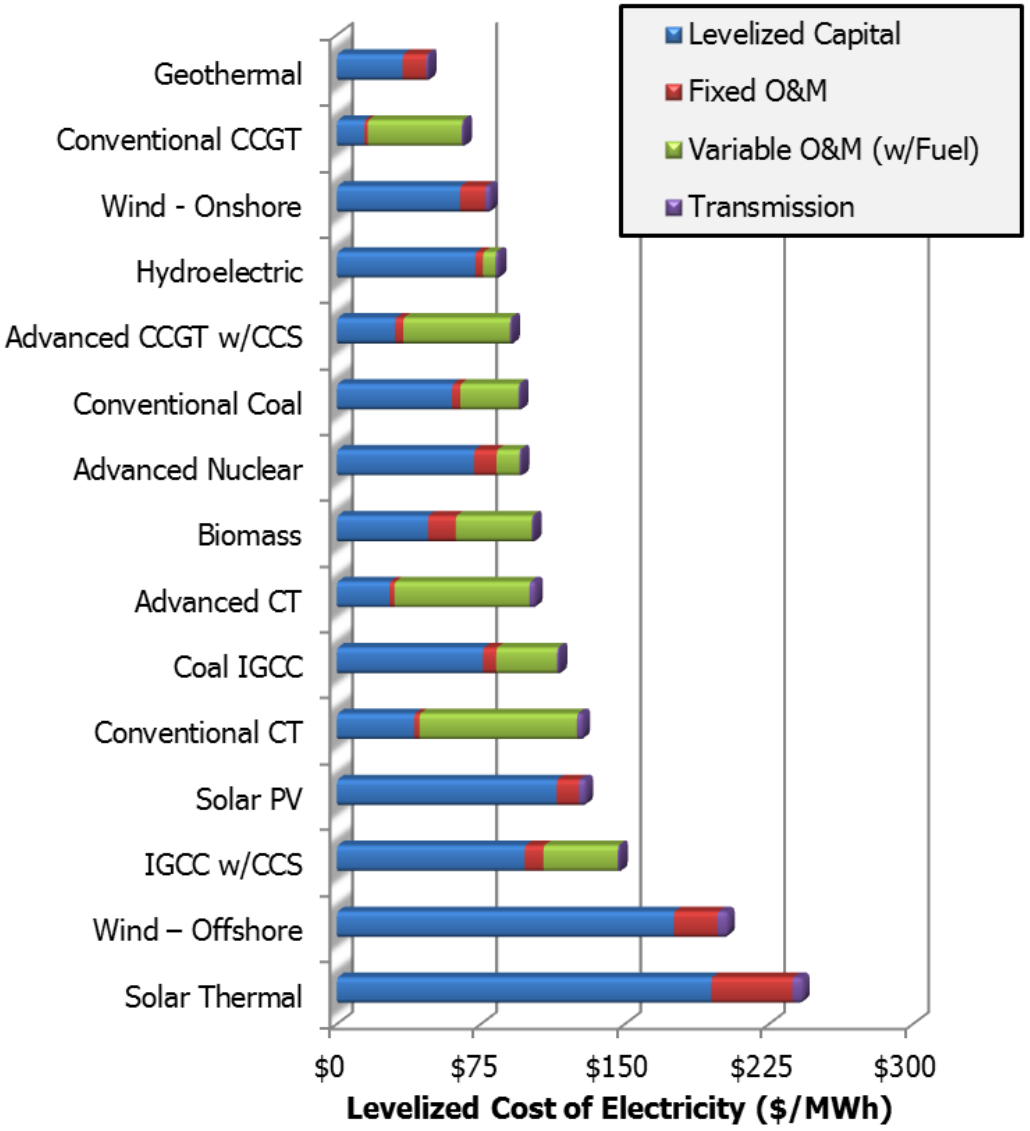
Acadia CCGT PB1 & PB2

Grand Gulf Nuclear Station

Source: www.entergy.com, regulatory approvals

Generating Technologies & LCOEs

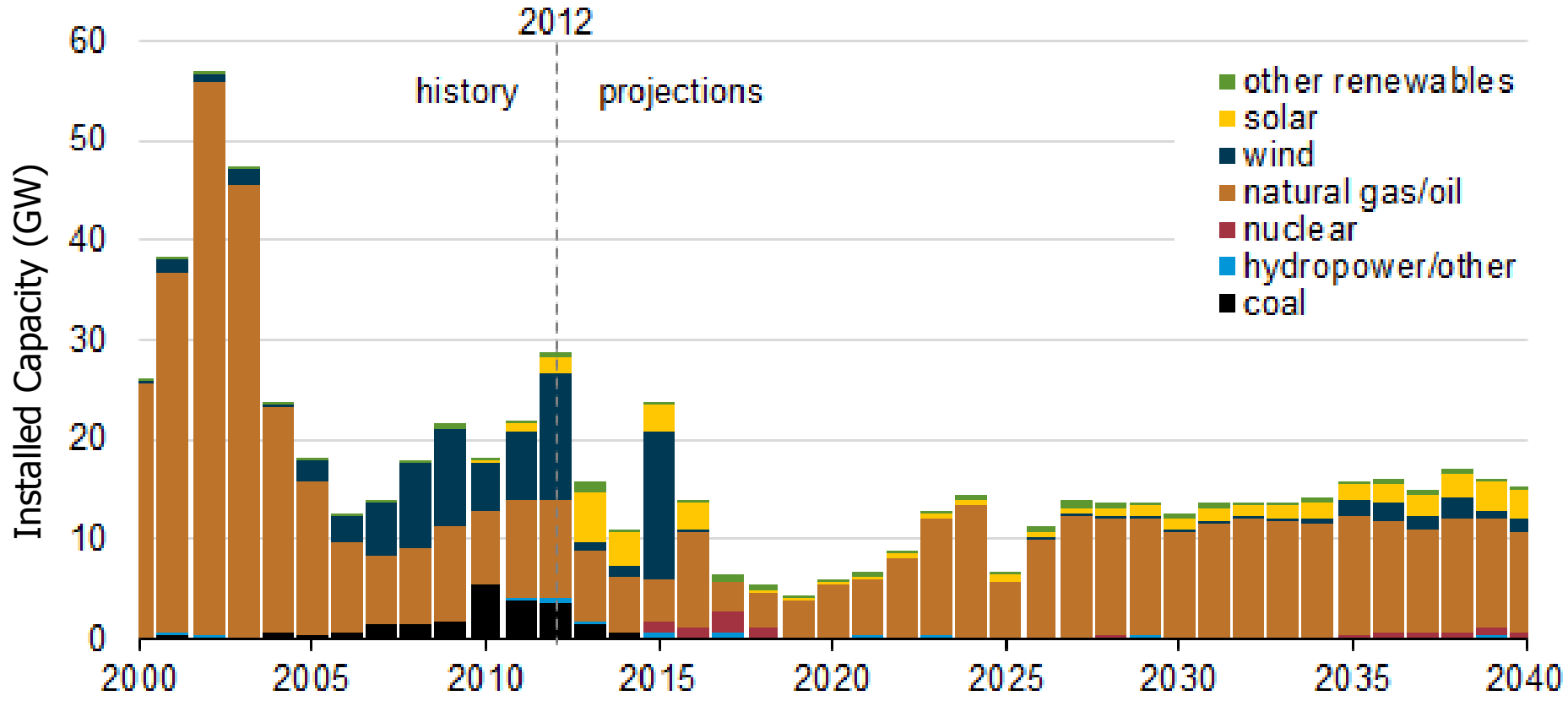
- Chart shows levelized cost of electricity by technology for projects coming on-line in 2019 ($2012; excluding subsidies)
- Longer-term projections of low and more stable natural gas prices and various environmental and renewable energy policies are drivers for utilities investing in lower-emitting technologies:
  - Natural gas-fired turbines
  - Land-based wind farms
  - Solar PV
  - Other renewables
  - Energy efficiency / DSM programs



Source: EIA, 2014 Annual Energy Outlook, July 2014

Long-Term Projections for the U.S.

- Takeaways for next 10 years (2015 – 2024)…
  - 0.5 – 1.5% annual growth in new generation capacity (average < 1%)
  - Vast majority of new capacity will be gas-fired CCGTs and CTs
  - No new coal units and only five new nuclear units (TN – 1, GA – 2, SC – 2)
  - As much as 15 GW of new wind by 2015 followed by negligible new wind farms after 2016 (PTC expiration)
  - Solar PV trails off in 2017 following reduction of federal tax credit (30% → 10%)



Source: EIA, 2014 Annual Energy Outlook, July 2014

Unintended Consequences

"In the economic sphere an act, a habit, an institution, a law produces not only one effect, but a series of effects. Of these effects, the first alone is immediate; it appears simultaneously with its cause; it is seen. The other effects emerge only subsequently; they are not seen; we are fortunate if we foresee them."
Frédéric Bastiat, What Is Seen and What Is Not Seen, Selected Essays on Political Economy, 1848

- So how does this concept relate to renewable energy policy? Consider these examples:

  Spain: In early 2012, Spain began to rein in renewable subsidies that had grown far beyond original forecasts (*e.g.*, generous feed-in-tariffs caused a boom in solar construction giving Spain many times the amount of solar capacity that the government had planned and budgeted for under its FIT policy)

  Germany: Because of renewable growth under its *Energiewende* policy, Germany now has among the lowest wholesale costs of power in Europe, which are comparable to the U.S.; however, the cost of that policy along with higher taxes and levies has caused German retail electricity rates to be among the highest in the world (e.g., residential rates of 35+ ¢/kWh and large industrial facilities paying the equivalent of 21 ¢/kWh according to Eurostat, the EU's statistics agency).

  Japan: Five of Japan's ten regional utilities just restricted new solar interconnections because the scale of development since 2012 when the country introduced a new FIT policy post-Fukushima have far outpaced their ability to integrate solar resources; e.g., Japan's east and west grids operate on different frequencies (50 vs. 60 Hz) and there is limited transmission between each of the utilities.

- The lessons from these countries are that policymakers should proceed cautiously and pursue renewables in a responsible manner that includes consideration of cost, reliability, and affordability.