Early Shutdown of GWF Coke Plants

Canary in the Coal Mine or Just More Crazy California?

DHN background

- Educational Background
  - BSME Iowa State University
  - MBA San Diego State University
  - Registered Professional Mechanical Engineer in California
- ~ 40 years of Experience
  - 1/3 with Investor Owner Utilities
  - 2/3 with Independent Energy Producer
  - Technologies:
    - Nuclear
    - Fossil: Coal, LSFO/Natural Gas and Petroleum Coke
    - and Renewables: Geothermal, Biomass and Solar
- Lived in California since 1976

GWF Background

- Started in early 1980's as a part of Allied Signal with a focus on employing technology to cleanly combust difficult fuels
- 3 Distinct Businesses
  - Petroleum Coke Power Plants (130MW)
  - Natural Gas Power Plants (500MW)
  - Solar Power Plant Development (125MW)
- All GWF businesses located in Northern California

Pet Coke Plant Background

- Started up 1st plant in late 1989, last of 6 plants on line in 1991
- All of the plants have operated on 100% petroleum coke for the past 20+ years
  - FERC QF certification as Small Power Producer, Waste Fuel
- Technology: Fluid bed combustors with limestone injection for SO2 control, Ammonia injection for Nox control, baghouse for particulate control
- Fuel source: Pet coke is a by product of crude oil refining process, and as such the coke from each refinery is unique, as well as being dependent on that refinery's crude slate (*which changes over time, unpredictably*)
  - Types: Delayed, fluid and flexicoke
  - Fuel Quality: 95+% C, 14,500B/lb Sulfur: 0.5% - 5% Ni and Vn 500-2,000ppm

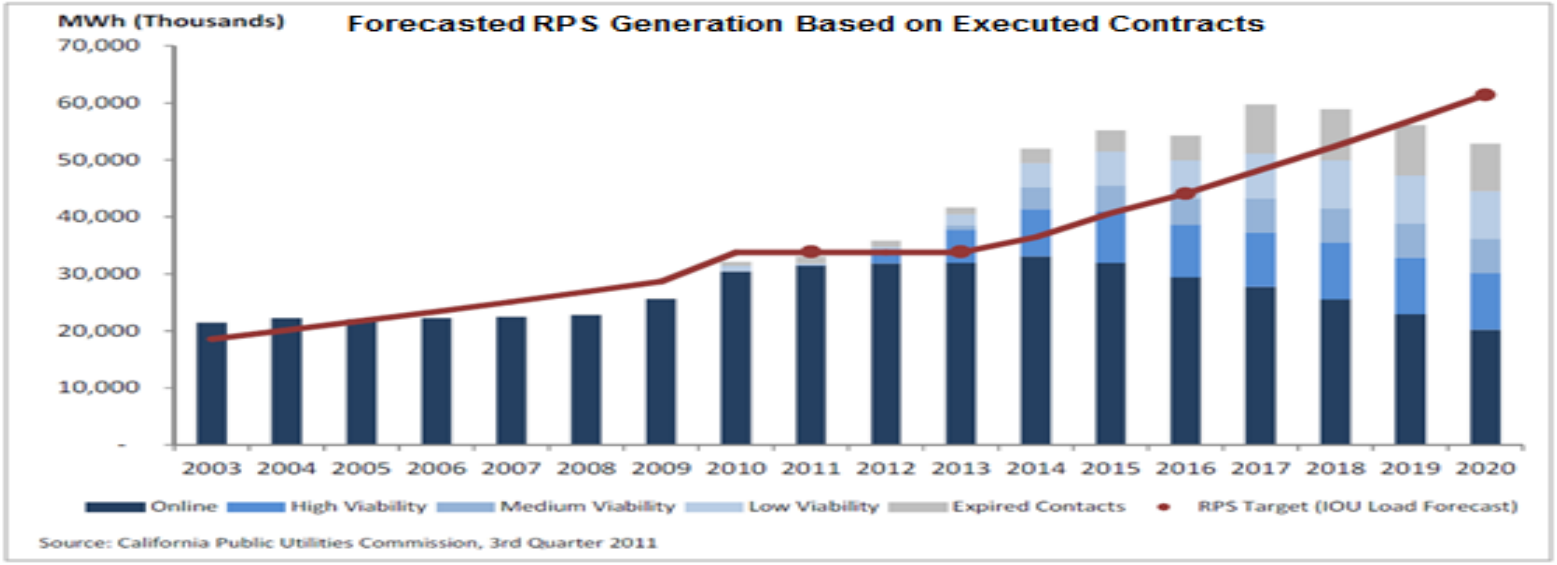
Highly Successful

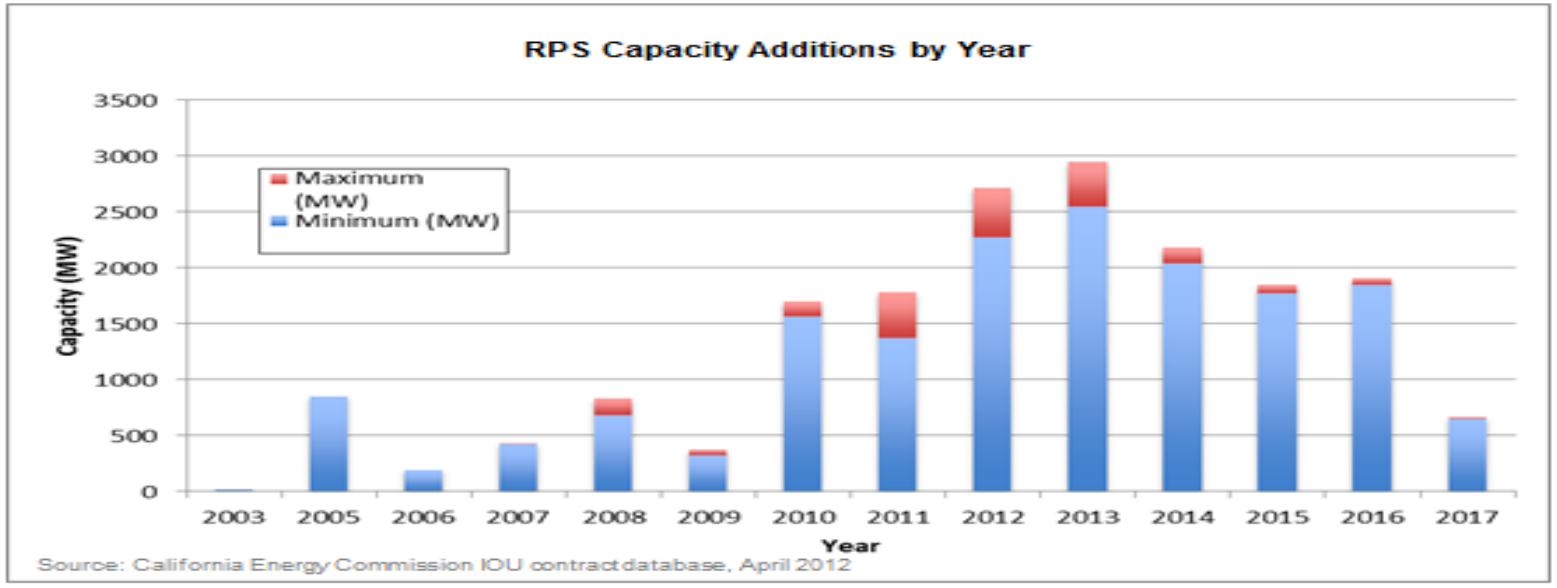
- Overall Capacity Factors of 95%+ over decades of operations, producing 1,000,000 MWh Annually
- Summer peak Capacity Factor's of 99%+
- Environmental performance was excellent: complying with stringent BAAQMD and SJVAPCD standards
- 100% recycling of combustion by products
  - Produced synthetic gypsum as a substitute for natural gypsum in cement kilns
-
- Located in dense neighborhoods in Bay Area, so clean operations was key success factor

Change in the California Winds As Y2K faded from Memory…

- *California's GHG Leadership*
  - AB32: Passed in 2006 and signed by Governor Schwarzenegger with a target of 1990 GHG levels by 2020
  - Cap & Trade with a price on Carbon, starts in 2013 *(no exemption for byproducts like pet coke)*
  - SB1358 set a standard Maximum Carbon Intensity Standard of 1,100 lbs CO2/MWh for new or extended base load PPA's (passed in 2006)
    - Effectively *eliminates in state and imports from coal & pet coke* unless CO2 is captured and sequestered, since **coal and coke emit over 2,000lbs CO2/MWh**
- ***33% of All California Electricity produced must be generated by Renewable Energy by 2020***
  - From ~10% in 2010 to 33% in 2020 means the addition of **~40,000 MW's of NEW Renewable Capacity**
    - Most of it is intermittent, either wind or solar, challenging grid frequency and stability

California's 33% RPS by 2020





Imagine A Pet Coke Power Plant Coming to California for a Power Plant Interview…

- Are you Energy Efficiency?
- Are you Renewable?
- Are you Fossil?
  - Do you play well as a support to your *much smarter, more attractive,* fellow renewable power plant, and be "unseen" until need?
  - What does your environmental footprint look like?
    - Are you more like Bigfoot or Littlefoot?

Desirable Attributes of a Fossil California Power Plant

- Low GHG Intensity
- Highly Flexible: Support Renewables
  - Multiple Starts per Day
  - Quick Start
  - Wide Load Range
  - Off, unless needed
- Low Criteria Emissions (SOx, NOx, PM10)
  - including mobile emission sources to support the plant
- Low Water Use
- No Solid Waste Products
- Low Cost
- Low labor Intensity

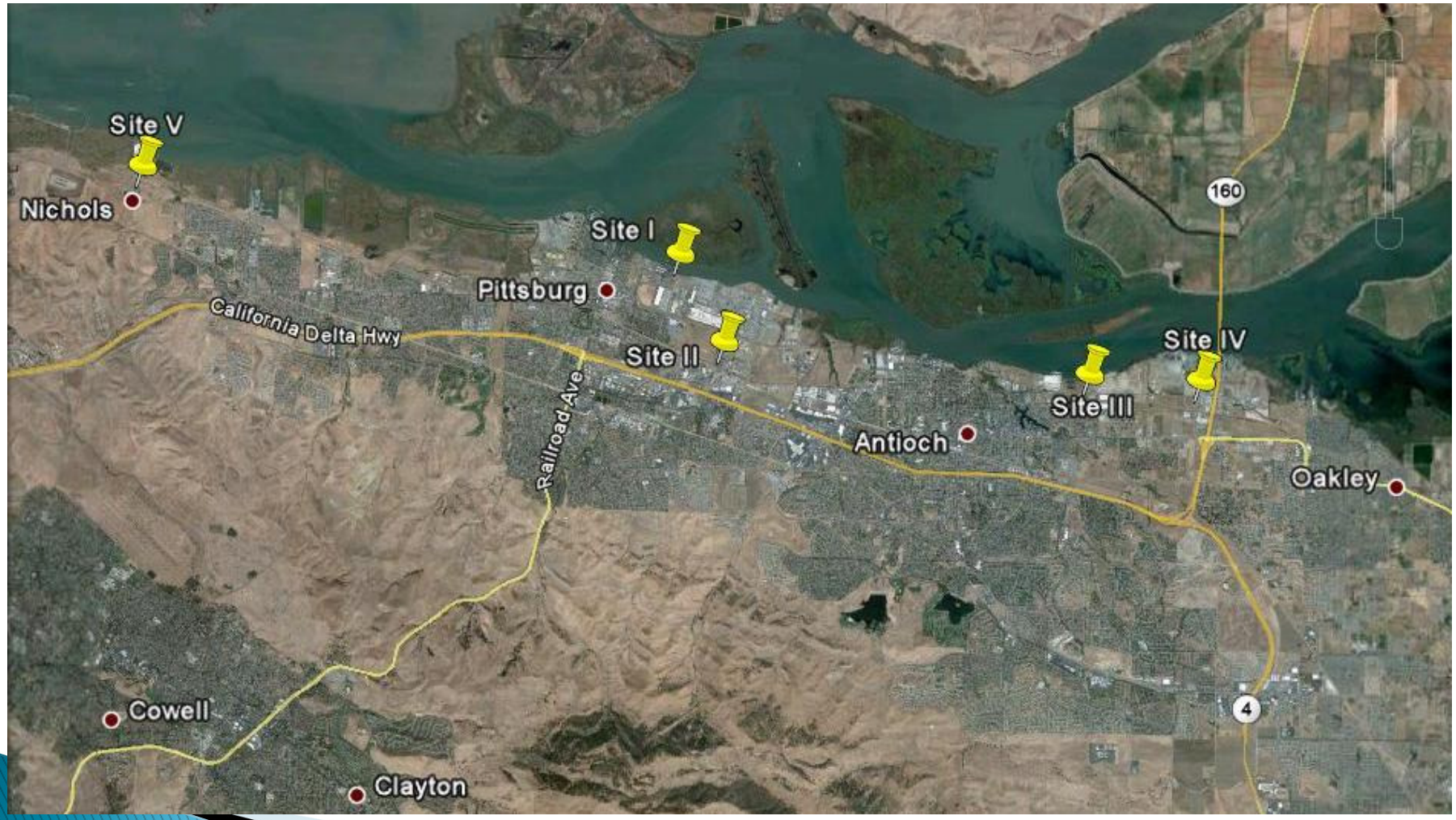
Job Interview:

Scoring Sheet

	Pet Coke	NG CT/CC	
Low GHG Intensity (tonnes/MWh)	1.2	0.4-0.6	√
Highly Flexible	No	Yes	√
Multiple Starts per Day	No	Yes	√
Quick Start	No	Yes	√
Wide Load Range	No	Yes	√
Dispatchable	No	Yes	√
Low Criteria Emissions (lb/MWh)	1.6	0.2	√
Low Water Use (gal/MWh)	700	8	√
No Solid Waste Products	80,000 tons	No	√
Low Cost (Variable w/GHG)	No	Yes	√
Labor Intensive	Yes	No	√

Which Plant Got Hired?

GWF Delta QF Power Plants



GWF Clean Power Initiative

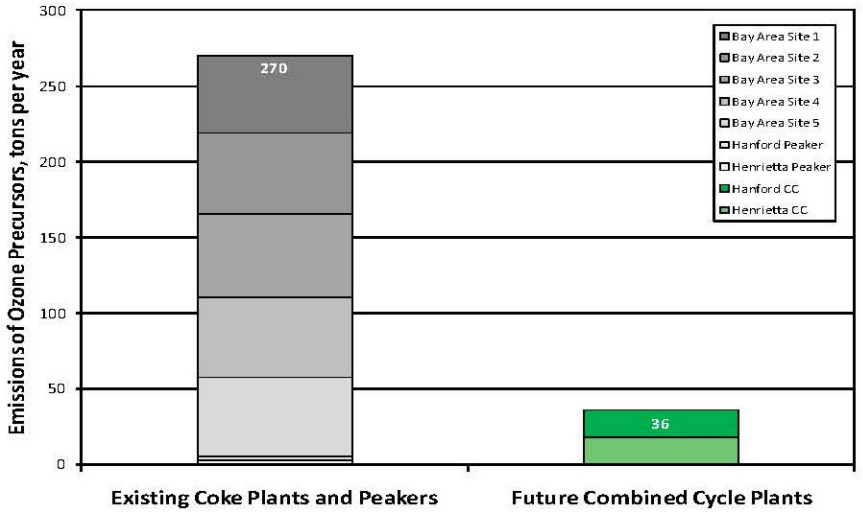
Environmental Benefits*

- Reduce by 2/3 almost 5% of PG&E's GHG emissions
- Reduce by 2/3 approximately 2.1% of statewide electric sector GHG emissions
- Reduction of criteria emissions from GWF power plants by 90%
- Reduction of water usage by 80% (saving 1,500 acre-ft/year) from Sacramento-San Joaquin Delta – a fragile ecosystem critical to the state's water supply
- Improved overall efficiency of electric system results in further emission reductions
- Enhanced ability to accommodate new renewable resources
- Compliance with SB 1368 emission levels across GWF fleet
- Improved air quality benefits in industrialized Contra Costa area

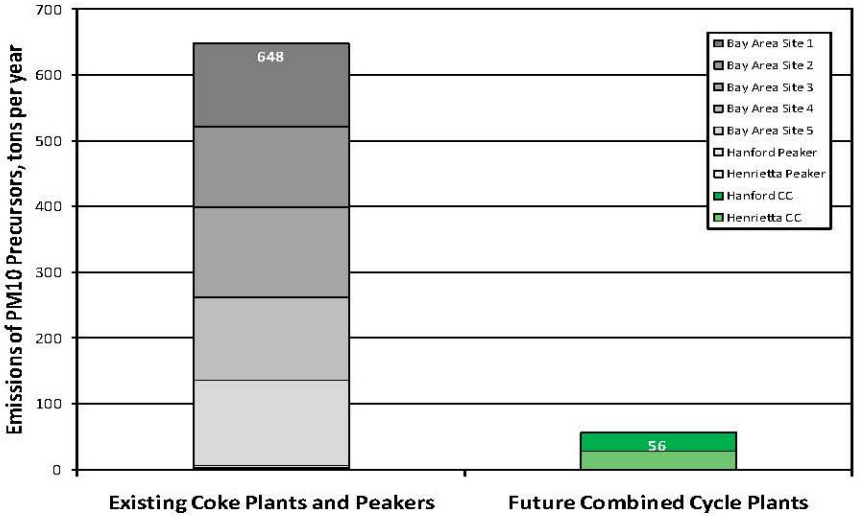
* Note: Environmental Benefits are calculated based on the same number of MW-hrs generated "before" and "after"

Environmental Benefits

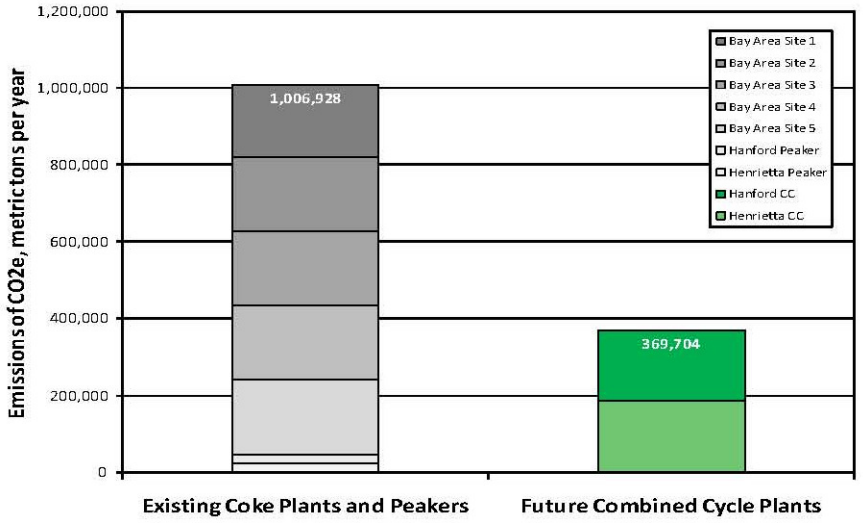
Comparison of Current and Future Emission Rates: Ozone Precursors, Tons/Year



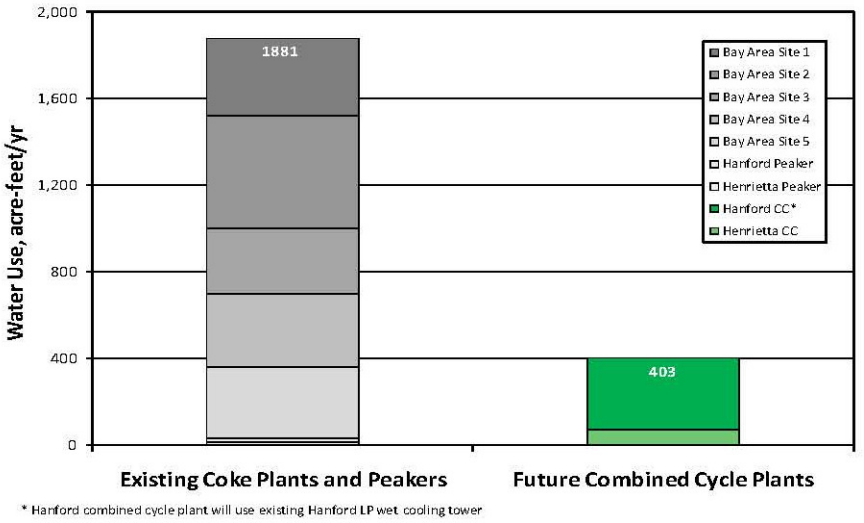
Comparison of Current and Future Emission Rates: PM10 Precursors, Tons/Year



Comparison of Current and Future Emission Rates: Greenhouse Gases, Metric Tonnes/Year



Comparison of Current and Future Water Use: Acre-Feet/Year



* Hanford combined cycle plant will use existing Hanford LP wet cooling tower

Initiative Approved!

- Application submitted to the California Public Utilities Commission on 7/26/2011to implement the shutdown of GWF's pet coke plants
- Application unanimously approved on 2/16/2012
- The pet coke plants were taken out of service permanently after the CPUC Decision after 20+ years of successful operations

Was This A Net GHG Savings?

What do you think?

- *In California, the 1,000,000 MWh of pet coke electrical production is being replaced by natural gas at the margin*

- *In Asia (likely market for the 300,000 tons of pet coke that is now available); the pet coke as a by product will be priced to move and will displace coal, reducing the demand for coal from Austrailia*

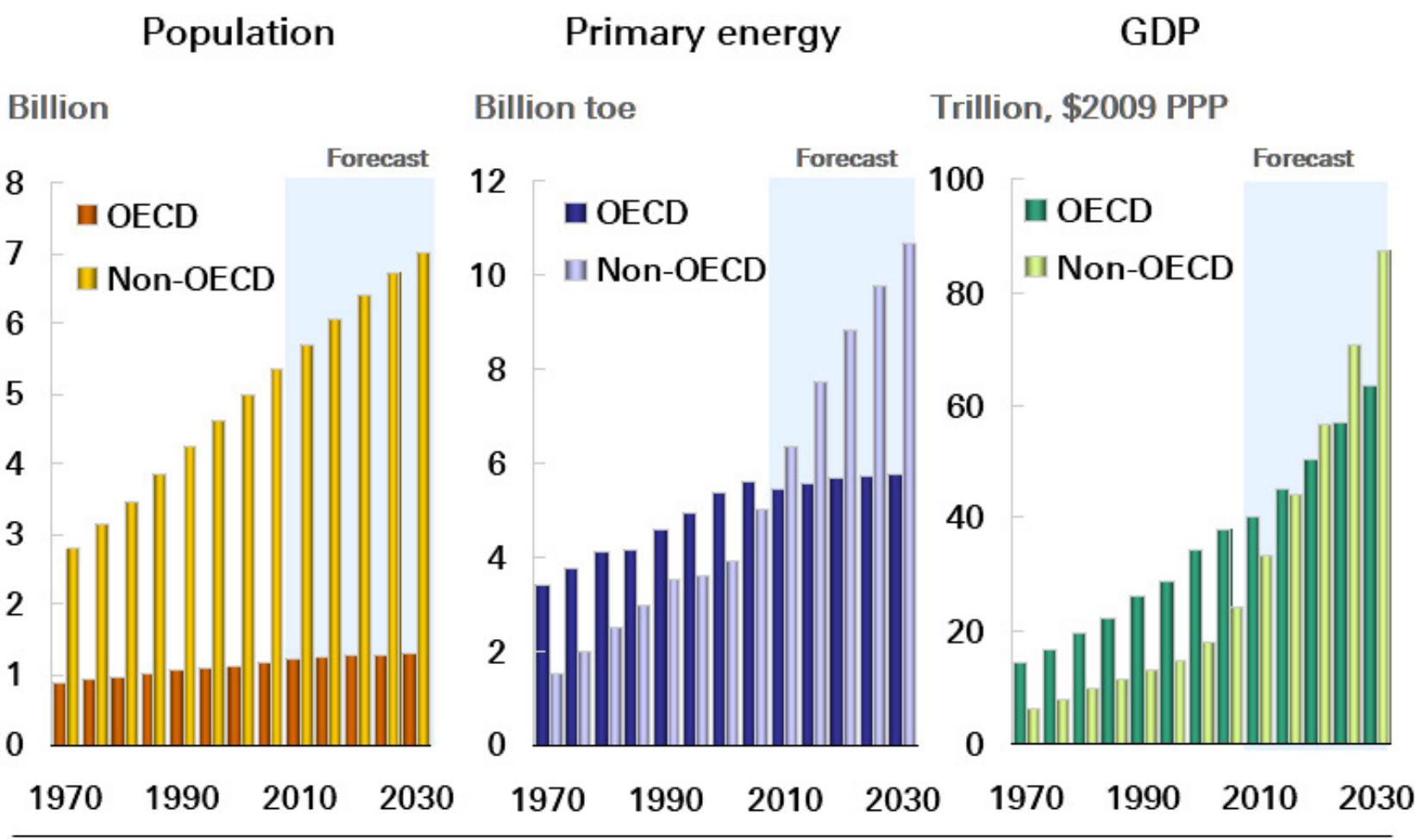
- ***Is the net effect a replacement of coal with NG, which is a significant reduction of GHG?***

What Does This Mean to Other 47 States?

That depends….

- What will the price of Natural Gas be in 5 years?
  - Is the use of fracking processes constrained?
  - How much Natural Gas is exported?
  - How much coal electric generation is replaced by gas, thereby raising Natural Gas Demand
  - What happens with existing nuclear in the US?
- What are the environmental costs for coal, including GHG, air emissions and solid waste?
- Liabilities associated with coal?
- Difficult Permitting for New Coal Plants?
- Does CO2 removal & Sequestering become economically feasible?

The world we live in…



What do these 2 cars have in common?

THANK YOU!