

A Conversation About Natural Gas for Nevada

Nevada New Energy Industry Task Force
Carson City, NV
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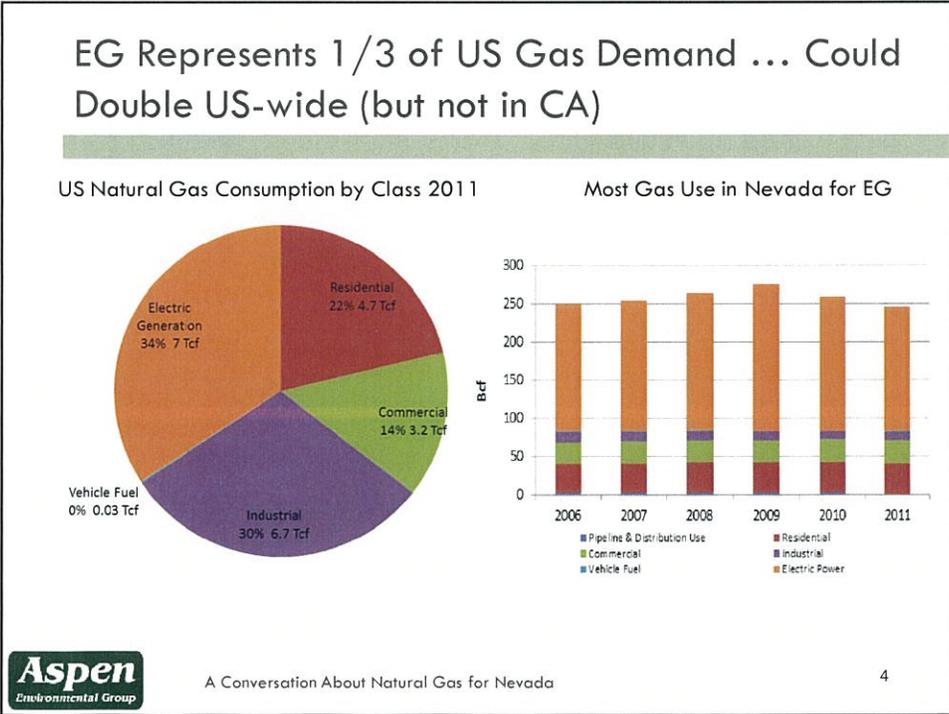
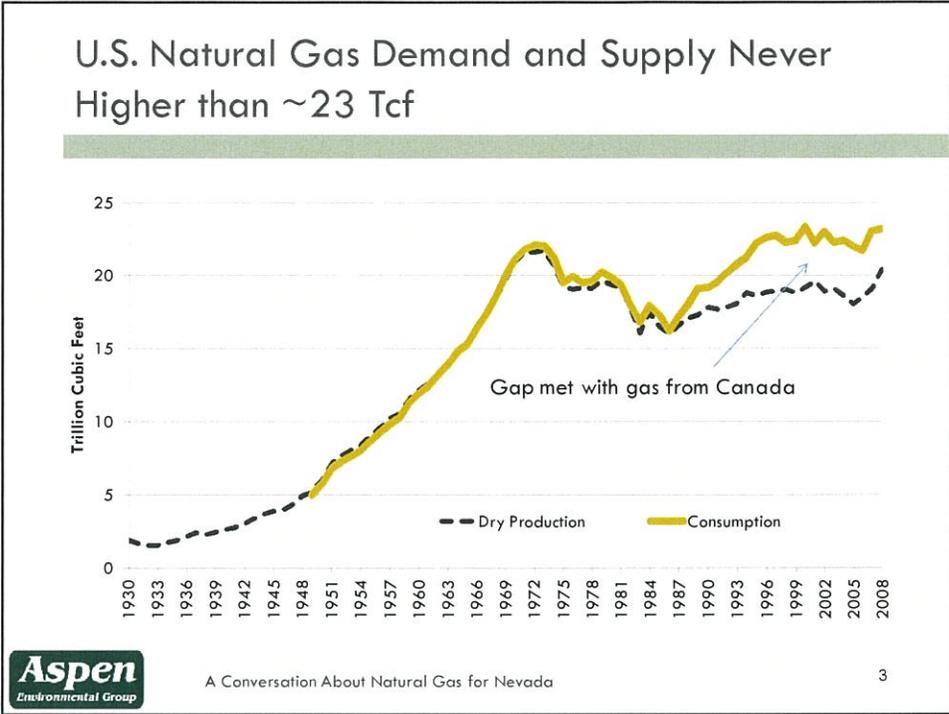
Lots of Ground to Cover Quickly

- How gas & electricity markets differ
- Existing and potential gas supply constraints, necessary infrastructure upgrades or expansions (including storage), costs and potential impact on gas pricing
- Overview of the historic volatility of natural gas prices
- How much gas used for electricity generation now and how much could be as EPA encourages switch to gas
- Work to better aligning gas and electricity markets
- International influences
- Hydraulic Fracturing

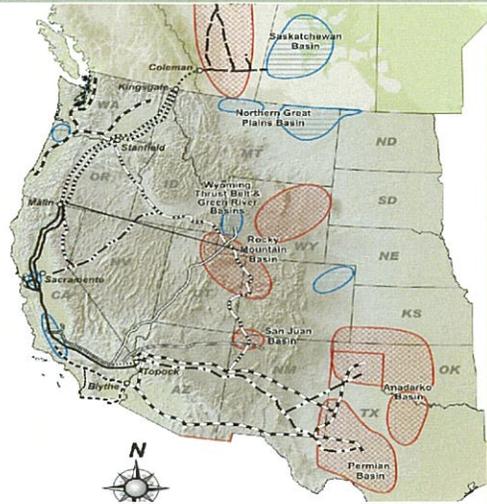


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Northern Nevada Receives Gas from Alberta & Rockies; South gets Mostly SW plus some Rockies

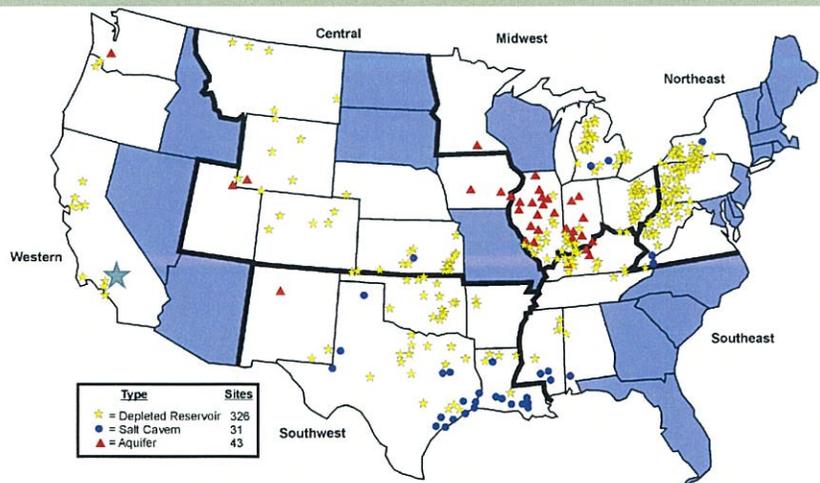


- EPNG Lateral to Southwest Gas
- Paiute from Williams' Northwest Pipe near Boise/Mt Home to Winnemucca and Reno – eastern lateral to Elko
- KRGT Las Vegas delivery points
- Tuscarora from Malin to Reno with couple drops inside CA
- Ruby interconnection to Paiute but no delivery point yet & postage stamp rate?



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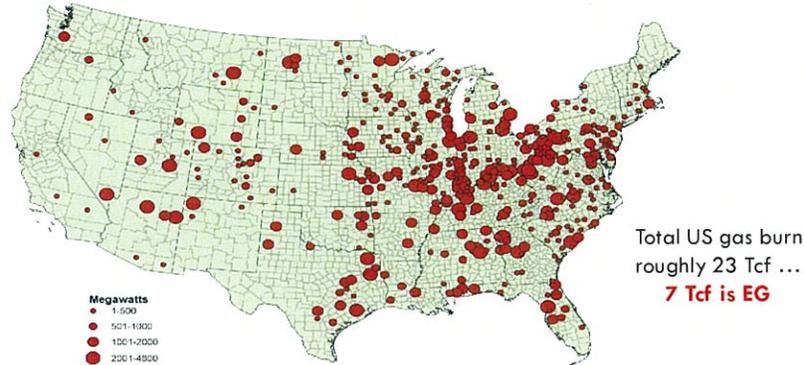
400 Underground Gas Storage Facilities In U.S -- None in Nevada. Storage enables flexible services.



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Replacing Coal's 335,000 MW Takes -- a Lot -- of Gas (14 Tcf) *even with renewables and EE*

One new 500 MW plant will burn 84 MMcfd if operates all 24 hours



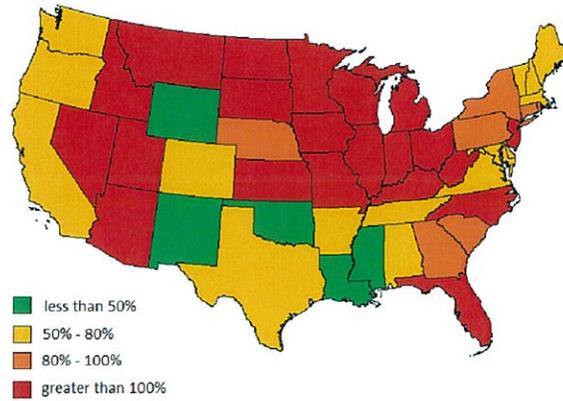
How Much Gas Is Burned By A 500 MW power plant?

- Basic formula is:

capacity MW * heat rate of unit * # hours

$$500 \text{ MW} * 7 \text{ MMBtu/MWh} * 24 \text{ hours} \\ = 84,000 \text{ MMBtu per day}$$

IF all Coal Switched to Gas, 27 States will have pipeline utilization > 80% in Peak Month

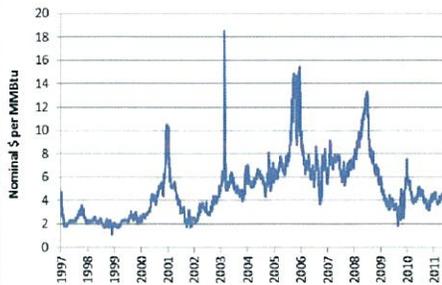


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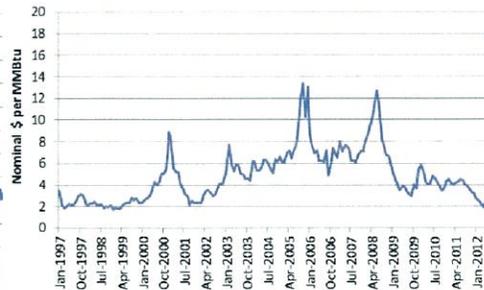
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Volatility is the Standard Deviation of Price Changes – Hedge to Erase Peaks & Valleys

Daily Spot Prices at Henry Hub



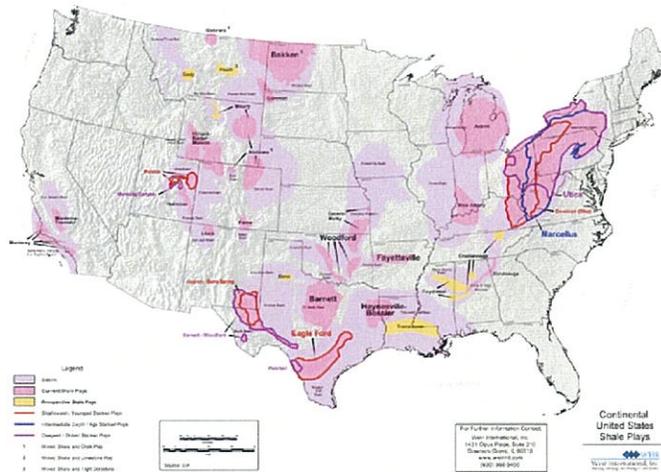
Monthly Spot Prices at Henry Hub



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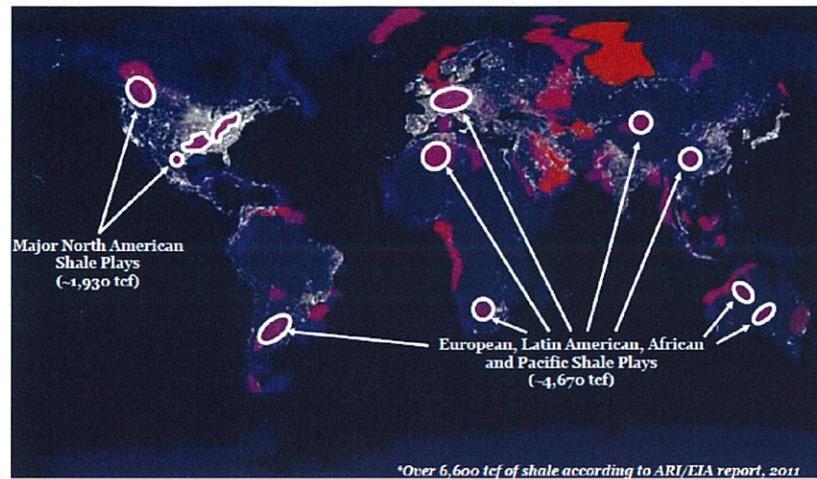
Shale Formations Often Under Existing Supply Basins BUT Different Ones More Prolific



The So-Called Game Changer Called Shale...

- Did NOT create a 100-yr supply of natural gas
 - Conventional fell off b/c could drill elsewhere and import as LNG
- Subsidy from oil and gas liquids revenue plus production profile means earn ROI very quickly ... preference to drill shale even if no increase in demand
- Some question how long wells will last
- Is exposing communities to drilling impacts where not previously experienced

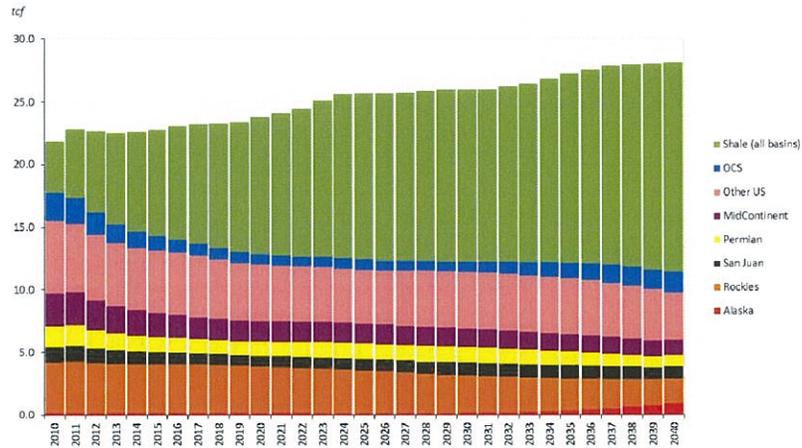
p. 20 of Medlock presentation at CEC Shows US has 1/4 of World-Wide Shale Resource



Fracturing Not New but Is New

- Fracking common in any rock formation that is “imperfect” – gas or oil doesn’t flow easily
- Original frac job southwestern Kansas 1947
 - 1000 gallons of naphthalenic acid and napalm
 - 2700 lbs pressure
- Today’s high volume slickwater fracturing is different than fracking commonly used in vertical wells
 - More water (2 to 10 million gallons), pressure, chemicals
 - different combination required in every formation

CEC/Rice Reference Case Shows 60% of US Gas Supply From Shale by 2040



Regulatory effort to address public opposition

- DOE subadvisory panel to Chu: “best practices” lacking
- DOI
- EPA Green Completions rule
- EPA study on drinking water impact
- White House interagency working group
- Industry says voluntary FracFocus and state Reg is enough: Disclosure laws passed various states
- Several incidents of blowouts or spills
- France has banned; protest in London; Poland hoping

June 2010 APPA Study ID'd Issues as EPA Drives Rush to Gas

- G/E dispatchers and control area managers don't communicate enough
- Discrepancy Gas Day Schedule versus Electric
- Gas system not built to support electricity generation
 - focus on seasonal, predictable "human needs" customers
 - power plants lowest end use priority
 - more plants on/off has bigger impact on system
 - protocols created 20 years ago, before big EG demand



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NatGas and Electricity Markets and Rules Are Very Different

- Price of natural gas was regulated by FPC/FERC
 - Mid-70's shortages led to curtailment in Midwest and then to Wellhead Decontrol Act, NGPA, FUA, PURPA
 - Excess supply => spot market => service unbundling
- Gas moves slowly ... 30 mph/no weekend market
- System designed to serve winter residential load
- We have storage! Underground, in pipe, boats
- North America has single Gas Day
- FERC permits all interstate pipeline additions/easy



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Gas/Elec Schedules aren't Synchronized

- 4 nomination windows for tomorrow's gas deliveries
 - Timely window before electric scheduling
 - Most pipes and LDCs require gas to be burned ratably
 - Gas burn may change after nom with change in weather
 - Changes after Timely intended for minor fixes

Cycle	Nomination Time	Confirmation Time	Effective Time
Timely	11:30am Day Prior	4:30pm Day Prior	Start of Gas Day
Evening	6:00pm Day Prior	10:00pm Day Prior	Start of Gas Day
Intraday 1	10:00am Day Of	2:00 pm Day Of	5pm Day Of
Intraday 2	5:00pm Day Of	9:00 pm Day Of	9pm Day Of

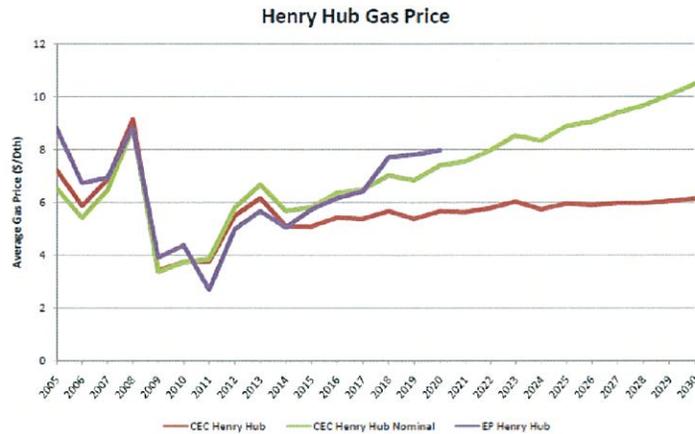


Are Efforts Underway to Better Harmonize NatGas and Electricity markets

- APPA Study/National Petroleum Council report
- NW Gas Summit Jan 2012
- Commissioner Moler questions led to FERC opening Docket AD12-12-000/six regional workshops
- NAESB Gas Electric Harmonization Committee
- ISO NW White Paper proposes putting electricity day first



Price Modeling 2011 EPNG Much Higher than CEC Reference Case



Bio and Quals

- Worked for PG&E 1986 to 1991 on industry restructuring
- Consulting more than 20 years; joined Aspen 2009
- Independent Fuel Consultant to lenders or developers on more than 40 gas-fired power projects in US and Canada
- Chief gas price forecaster at RW Beck Inc.
- Key clients have included California Energy Commission, APPA, Diamond Generating, Marathon Oil, Calpine
- Education: University of California, Berkeley in Political Economy and MPP Kennedy School of Government Harvard University