

Implications of Greater Reliance on Natural Gas for Electricity Generation

Gasification Technologies Conference

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Study Sponsored by APPA & UARG

- Genesis was hearing from EPA that staff believes switching all or most coal-fired generation to gas is easy
- Rulings on permits increasingly requiring look at natural gas as BACT
- Cost of plant modifications to comply with Transport rule, Hg, coal ash greater than building NatGas CC
- Study looks at what it actually takes to switch the coal-fired fleet over to gas

Bottom Lines

- Takes a LOT of Gas to replace coal-fired units
 - Is a LOT of new Pipeline and Storage
 - Requires modification of natural gas delivery/interface SOPs
 - Isn't as Easy as it Looks
- ... costs more and will take more effort than EPA (or the natural gas industry) think (admit)

Why Replacing Coal Not So Easy

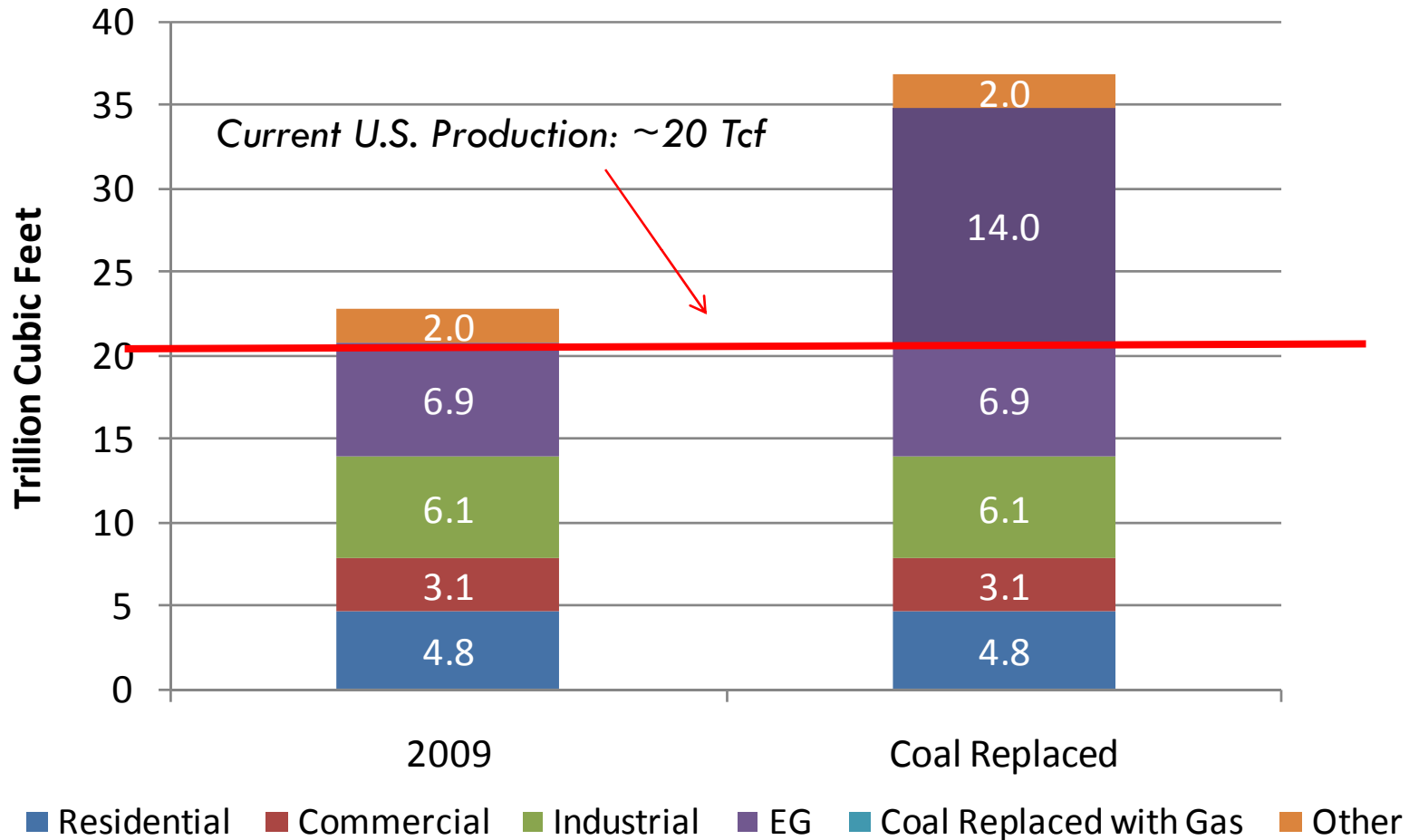
- It is a LOT of gas
- 335,000 MW of coal-fired generation
- Operated at 72% capacity factor in 2008

$$335,000 \text{ MW} * 7 \text{ MMBtu/MWh} * 24 \text{ hours} * .72 \\ * 365 \text{ days} =$$

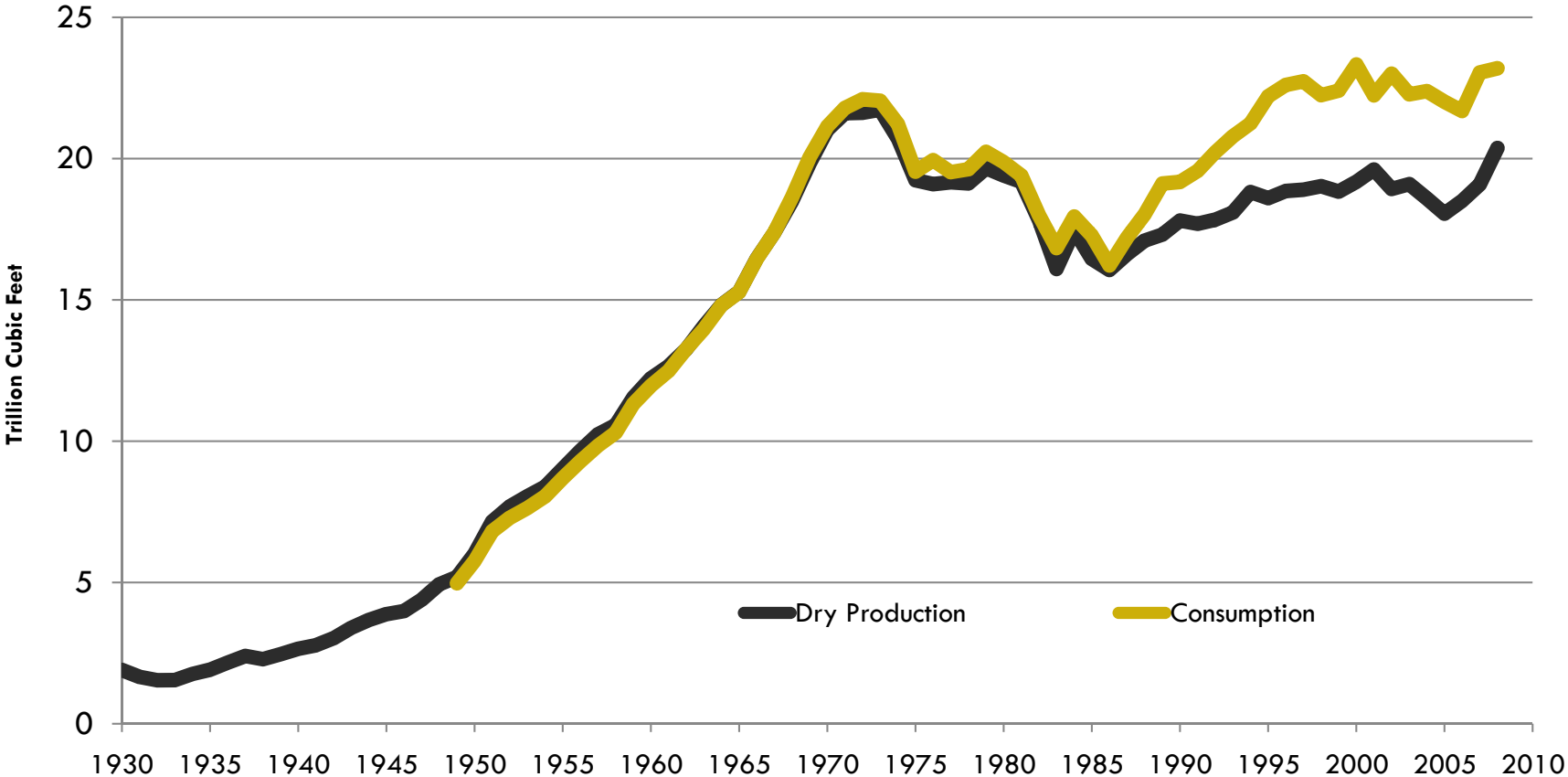
14.1 Trillion Cubic Feet

Annual incremental natural gas demand

60% More Gas than Used Today



Never Really Done More than Today



Carbon-Reducing Scenarios w/o CCS

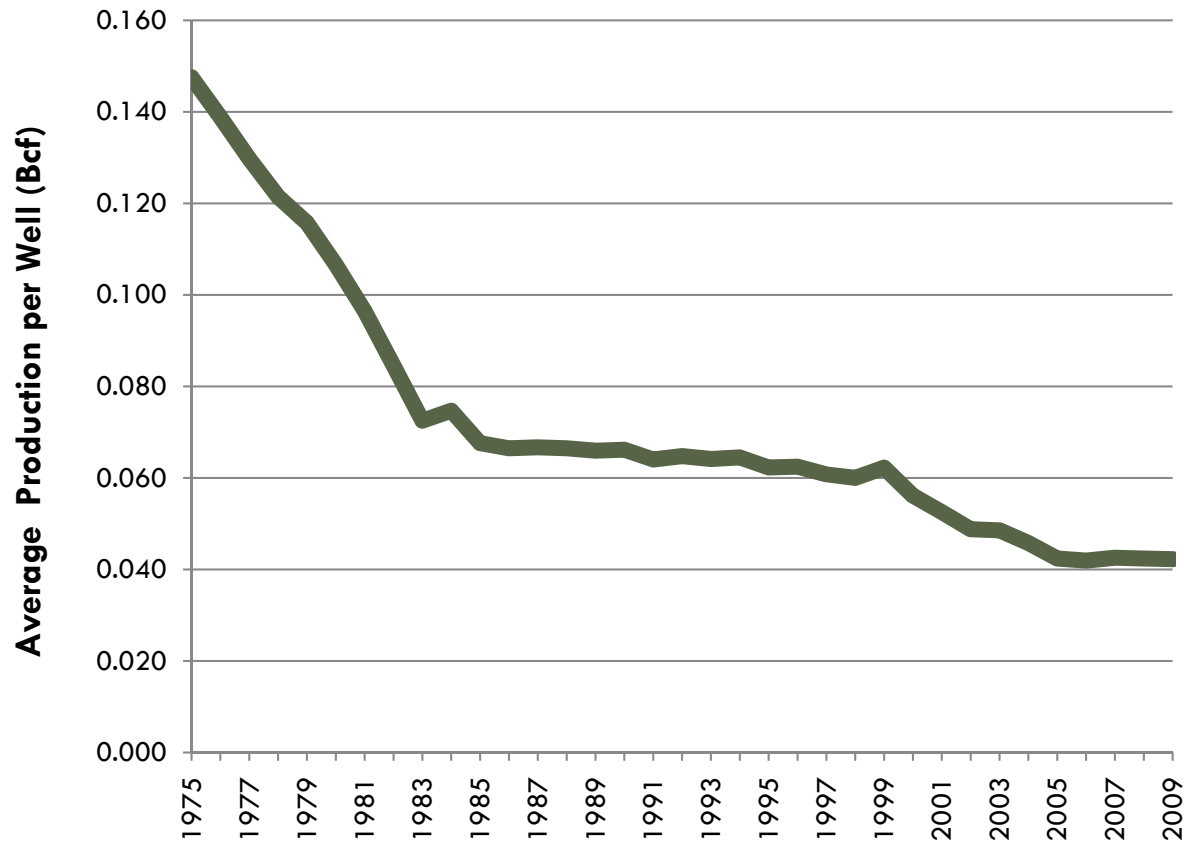
Produce High Gas Demand

	Resource Mix Alternatives				
	1	2	3	4	5
Load Growth	1.00%	0.41%	0.41%	0.41%	0.41%
Nuclear	19%	23%	23%	23%	23%
Renewables	9%	20%	20%	20%	20%
Coal	31%	35%	28%	13%	5%
Coal CCS	2%	3%	3%	3%	3%
NatGas	33%	12%	19%	35%	43%
Petroleum	2%	2%	2%	2%	2%
Hydroelectric	5%	6%	6%	6%	6%
Total	100%	100%	100%	100%	100%
Emissions in 2030	2,669	2,082	1,912	1,574	1,344
Gas Burn for EG in 2036 (Tcf)	13.8	5.1	7.7	12.5	15.1
Gas Burn for EG in 2030 (Tcf)	11.9	4.1	6.8	11.0	13.8
Total US Gas Demand	29.8	21.1	23.7	28.5	31.1

But We Have Shale!

- There is a Lot of It
- Higher capital cost to drill but hyperbolic decline and liquids content allow quicker ROI
- Relies on production technique that
 - Uses lots of water and pressure to fracture rock
 - Concern about proppant chemicals reaching drinking water – EPA study requested by Congress
 - Potentially higher carbon emissions from additional truck trips, higher Btu content of the gas, claimed higher fugitive emissions?

Have to Drill Lots of Wells



New Wells Required to Produce X Tcf More Gas Supply Than From Old Wells

<u>X</u>	<u># Wells Required</u>
1	6,299
2	12,597
3	18,896
4	25,195
5	31,493
6	37,792
7	44,091
8	50,389
9	56,688
10	62,987
11	69,285
12	75,584
13	81,883
14	88,181
15	94,480

Additional Findings

1. Need to build more interstate pipeline capacity than built in last 25 years
2. 27 states would need new pipe into the state plus laterals to burnertip (assume CC's built at existing coal plant sites)
3. Storage allows pipelines and LDCs to be more flexible but building storage HARDER than building pipe
4. Need some rules changes at Interstate and LDC level to address operational issues
5. States need to look at Priority of Service (curtailment rules)
6. Studies that looked at Hurricane impacts to gas system looked at wrong issue
7. Conversion does NOT = retrofit of coal plants to burn gas, it means REPLACEMENT of plant with NEW plant