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**What Does the Future Hold for  
Natural Gas?**

Ken Costello  
Principal Researcher  
National Regulatory Research Institute  
[kcostello@nrri.org](mailto:kcostello@nrri.org)

# Consensus on the Benefits of Natural Gas

- Natural gas has contributed to the economy by creating new jobs and reducing households' and businesses' energy bills
- Natural gas also has benefited the environment by accelerating the retirement of coals plants:
  - ✓ The shift from coal to natural gas was a major factor in lowering U.S. energy-related CO<sub>2</sub> emissions by 12 percent between 2005 and 2015
- Because of its abundance of shale gas, the U.S. expects to be a net exporter of natural gas

# Recent Opposition to Natural Gas

- We have seen a two-prong attack on natural gas:
  - ❖ The urgency to bypass natural gas as a “bridge fuel” and go straight to renewable energy for electricity generation
  - ❖ The need to advance what industry observers call “electrification,” where customers switch from natural gas and other fossil fuels to electricity for direct use (especially transportation, and water and space heating)
- A major shift from just a few years ago when:
  - ❖ Environmentalists and most energy experts supported natural gas as a “bridge fuel” in smoothing the transition of the electricity sector from fossil fuels to zero-carbon energy, particularly by accelerating the decline in coal use

# Anti-Gas Arguments

- Public policy can assist in replacing coal with renewable energy, at reasonable cost, and slash U.S. greenhouse-gas emissions without the problems of “fracking,” and CO<sub>2</sub> and methane emissions
- By sinking hundreds of billions of dollars into new natural-gas infrastructure instead of expanding renewable power, the U.S. could lock itself into a carbon-based future that poses high risk for catastrophic climate change
- Because natural gas systems leak methane – a potent greenhouse gas – a shift from coal to natural gas could actually aggravate climate change

# Pro-Gas Arguments

- Cleaner energy sources like natural gas along with zero carbon-emitting sources like renewable energy have increasingly displaced the use of dirtier fossil-fuel sources
- Natural gas is abundant and cheap, with expectations that prices will remain low over the next several years
- Natural gas competes most strongly in the electric power sector, because it has much lower CO<sub>2</sub> emissions than coal and has relatively low levelized cost
- In sum, what natural gas has going for it is plenty:
  - ❖ Abundant domestic availability
  - ❖ Low price for the foreseeable future
  - ❖ Relative cleanliness when compared with other fossil fuels
  - ❖ Flexibility in electric power production (e.g., base load, peaker and back-up to renewable energy)

# Future Options for Natural Gas

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- *Immediate phase-out* of natural gas has negative consequences, especially for electricity costs and reliability
- *Staying with natural gas too long* may conflict with a deep decarbonization policy
- *Bridging natural gas to the future* seems most sensible
  - ✓ The question then turns to the length of the bridge

# Carbon Targets and the “Bridge” Length for Natural Gas

- **450 ppm** (target temperature limit of around 2°C): allows the use of natural gas for a short time, peaking before 2030
- **350 ppm** (target temperature limit below 2°C): requires removing CO<sub>2</sub> out of the atmosphere and stop using all fossils fuels immediately
- **550 ppm** (large negative climate impacts): assumes that natural gas can play the role of a bridge, peaking in usage around 2050

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The pre-industrial concentration of CO<sub>2</sub> in the atmosphere in the 1750 to 1850 timeframe was about 280 parts per million (ppm); the current level of CO<sub>2</sub> is around 400 ppm

## Some Comments

- Phasing-out natural gas for electricity generation in (say) the next 10 years to be replaced by renewable energy does not seem feasible, let alone economical
- The “quick phase-out” policy is, in effect, an all-in bet on renewable energy, which may be our best opportunity to achieve carbon-dioxide emissions of 450 ppm or a temperature limit around 2°C; but it is a risky bet from an economic and electric-system reliability perspective
- Given the present state of natural-gas technologies, if the country pursues a deep decarbonization policy, it seems that natural gas will have to be phased-out and fall outside the long-term mix in electricity generation and for some end uses

## Some Comments – *continued*

- In the absence of a substantial climate-change policy, the U.S. and the rest of the world will likely rely heavily on fossil fuels indefinitely: Over the next several years, renewable energy will unlikely play a primary role in base-load electric generation or as a replacement for petroleum-fueled transportation vehicles
- One vital role for natural gas in the future is to serve as a *cost-effective transitional fuel* until zero or lower-carbon energy sources become more economically attractive
- A second role is to act as a *safety net or hedge* against (1) the disappointing performance of renewable energy and other forms of clean energy, and (2) a *laissez faire* policy on climate change

## Some Comments – *continued*

- Lower natural-gas prices have contributed to the displacement of coal, but they also have boosted overall energy consumption and have had an adverse effect on nuclear power and renewable energy
  - ✓ Some analyses conclude that the abundance of natural gas will likely have only a minimal effect on greenhouse-gas emissions over the next decade or two
- The consensus is that the EPA's estimates of methane emissions throughout the natural gas system are (1) overly optimistic, but (2) still below the level that would neutralize the effect of coal-to-gas switching on the level of greenhouse gases

## Some Comments – *continued*

- A reasonable policy is to encourage the expansion of natural gas for different uses (e.g., for homes and businesses) rather than its suppression
  - A proper balancing of economic and environmental considerations would likely reach that conclusion
  - Those who advocate less natural-gas usage generally skew their finding by giving little if any weight to the economic effects
  - Their obsession centers on the urgency of controlling climate change, no matter the cost
  - Climate change concerns should certainly be a factor in developing energy policy, but not the sole or even overriding factor

# Future Challenges for Natural Gas

- The questions about natural gas are complex and require consideration of the overall effect of an action on society, instead of just what happens to climate change
- Natural gas provides identifiable economic benefits but the environmental effects have come under attack and are subject to legitimate questioning
- *Electrification*, where customers switch from natural gas and other fossil fuels to electricity for direct use (e.g., transportation, water and space heating), does not seem to be a major threat to natural gas in the near future, but it will likely be in the longer term

# Future Challenges for Natural Gas – *continued*

- It will be ill-advised for the natural gas industry to underestimate the importance of R&D for making natural gas more carbon friendly
- While the abundance of competitively-priced natural gas points to a bright future, it is critical for the industry to spend more on technological developments that will make natural gas more environmentally and overall socially acceptable
- Any public-policy dialogue on the future role of natural gas should steer away from “rhetorical heat” and toward “analytical light,” which is especially hard to do when climate change becomes part of the discussion

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# Secondary Slides

# Facts on Natural Gas

- In 2016, 36 percent of natural-gas consumption was for electricity generation, 28 percent for industrial use, 16 percent for residential use, and 11 percent for commercial use
- Natural gas-fired electricity generation is about 30 percent of total electricity generation, which has grown almost continuously since the 1990s; natural gas is now the largest fuel source for electricity generation and will continue to be over the next several years
- For most of the country, natural gas is the most economical energy source for homes and businesses
- The shift from coal to natural gas was a major factor in lowering U.S. energy-related CO<sub>2</sub> emissions by 12 percent between 2005 and 2015
- The U.S. has an abundance of relatively low-cost natural gas that it can depend on for several decades

# Facts on Natural Gas

- Natural gas has been a “coal killer” (a “nuclear power killer” to a lesser extent), largely because of its low price and smaller footprint on the environment
- The flexibility of natural gas has increased the value of renewable energy on electricity grids
- Natural gas without carbon capture and sequestration is not a deep decarbonization option when compared with energy efficiency, nuclear power, and renewable energy: it is a fossil fuel that emits both CO<sub>2</sub> and methane
- Nearly one quarter of methane emissions in the U.S. comes from the natural gas supply sector, which is the largest source
- Shale gas has had a significant effect on bolstering the economy by creating new jobs, adding to disposable income, and reducing households’ and businesses’ energy burdens

# Facts on Natural Gas

- Over 50 percent of U.S. natural gas production comes from the combination of “fracking” and horizontal/directional drilling techniques applied in shale formations
- Lower natural-gas prices help to displace coal, but they also boost overall energy consumption and have an adverse effect on the economics of nuclear power and renewable energy; thus, the overall effect of shale gas on climate change becomes an empirical question