Natural Gas

North Carolina

Energy Policy Council

March 18, 2010

Natural Gas
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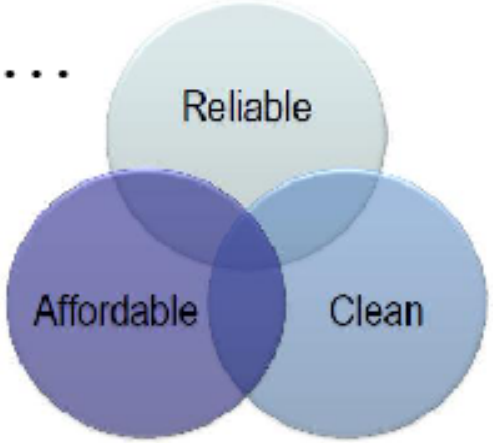
Piedmont Natural Gas

Natural Gas Energy Policy Council Objectives

Develop a long-term energy policy that includes:

- Energy efficiency
- Low carbon energy supply
- Low carbon transportation
- Which are…

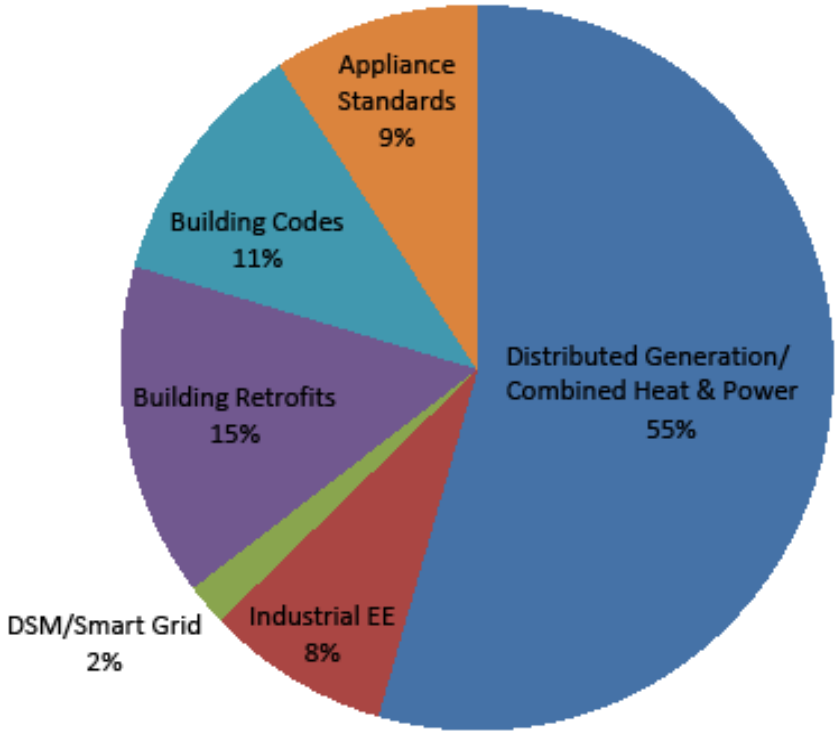


Priority of Solutions

1. Pursue natural gas related **energy efficiency programs**
2. Support policies to increase the **supply** and use of natural gas
3. Utilize natural gas as a **transportation** fuel

Energy Efficiency Potential: Energy Savings

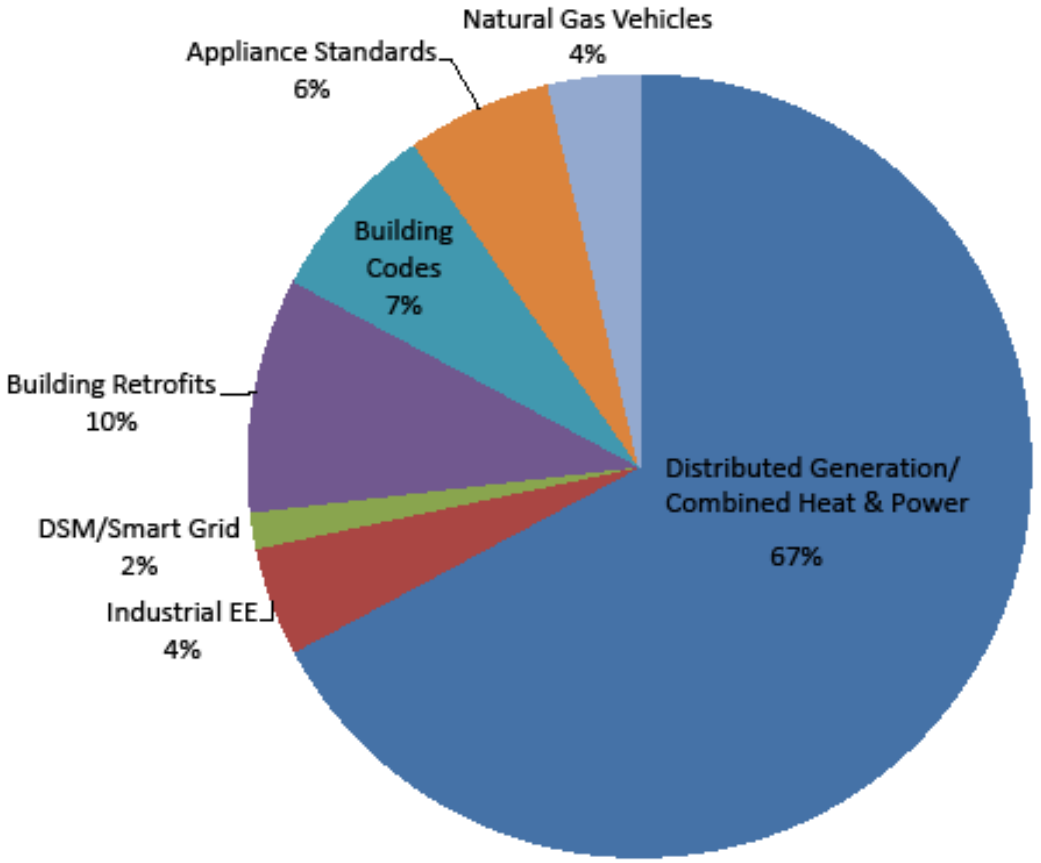
*Proposed policies are projected to save up to **120 trillion BTUs** annually by 2020-weighted savings by source shown in chart*



- Efficiency measures provide positive net present value (NPV)
- Techniques leverage inherent efficiencies of direct use combined with reduced loads and efficient appliances
- Energy savings are calculated for gas end uses only, although savings can include other fuels (e.g. CHP reduces grid supplied electricity consumption)

Energy Efficiency Potential: Emissions Reductions

*Proposed policies are projected to reduce carbon dioxide emissions by up to **13.4 million metric tons** annually by 2020-weighted reductions by source shown in chart*



Matrix: Energy Efficiency

Energy Efficiency	Potential- 2020	Policies	Price	Pollutants- 2020	People
Combined Heat & Power (CHP)	Reduce annual primary energy consumption by up to 67.0 trillion BTUs, including up to17,000,000 MWh electricity production (3,000 MW total capacity)	-Promote CHP supportive rates and tariffs -CHP directed financial incentives -Output based air regulations and enhanced permitting - RD&D programs -Consider including CHP/waste heat recovery REC in RPS -Coordinate with EPA CHP Partnership -Consult European CHP Directive best practices (CHP provides 13% of electricity & services 15% of the heating market in EU-25) -Consult Alliance to Save Energy position on efficiency best practices -Consult National Academy of Sciences on Energy Efficiency Cycle best practices	$1,500 kW (electricity capacity) with up to $400 million in commercial and industrial energy cost savings from avoided electricity and gas purchases (using national EIA projected electricity and gas prices in 2020).	Reduce CO2 emissions by up to 9.0 million metric tons (MMT)	Up to 9,000 cumulative highly skilled technical jobs by 2020 (based on U.S. DOE CHP report jobs methodology- see appendix for reference)
Industrial Sector: Waste heat recovery, steam systems, process heating	Reduce annual primary energy consumption by up to 10.2 trillion BTUs	-Encourage policies that balance environmental performance with manufacturing competiveness through affordable energy supply and efficiency -Offer tax incentives for energy efficiency and offer voluntary gas energy efficiency programs. Focus on high energy intensity sectors using improved controls, high efficiency boilers, and waste heat recovery systems, while pursuing hybrid gas renewable systems R&D.	Industrial sector efficiency measures are focused on the most energy intensive industries and the most cost-effective efficiency solutions. It is imperative solutions that demonstrate very favorable return on investments. ($1.0 – $4.0 MBTU)	Reduce CO2 emissions by up to 0.6 million metric tons (MMT)	Through reducing non-labor costs (e.g. energy) it can improve worldwide competiveness; thus, saving North Carolina industry related jobs.

Matrix: Energy Efficiency

Energy Efficiency	Potential- 2020	Policies	Price	Pollutants- 2020	People
DSM /Smart Grid	Reduce annual primary energy consumption by up to 2.3 trillion BTUs	-Provide Incentives for intelligent gas and electric metering systems Provide Customers with real-time gas and electricity usage feedback to save consumers money and reduce energy usage -Promote natural gas technologies as part of DSM/Demand response EE programs	Cost of Saved Energy Variable ($0.0 – $6.5 MBTU)	Reduce CO2 emissions by up to 0.2 million metric tons (MMT)	Design and installation work will occur within North Carolina Jobs totals unknown.
Building Retrofits including appliance retirement solar thermal programs	Reduce annual primary energy consumption by up to 18.3 trillion BTUs	-Structure and evaluate electric and gas efficiency programs in a manner that allows collaboration (cost –effective building retrofits reduce electricity and gas usage). -Consider revolving loan programs, financing districts and other state and municipal approaches to financing retrofit applications -Building energy and GHG emissions labels	Cost of Saved Energy Variable ($3.0 – $11.5 MBTU)	Reduce CO2 emissions by up to 1.3 million metric tons (MMT)	Significant jobs potential- the work is hands–on , site-specific labor that cannot be outsourced overseas and employees skills that any experienced construction worker or HVAC installer can acquire with minimal training.

Matrix: Energy Efficiency

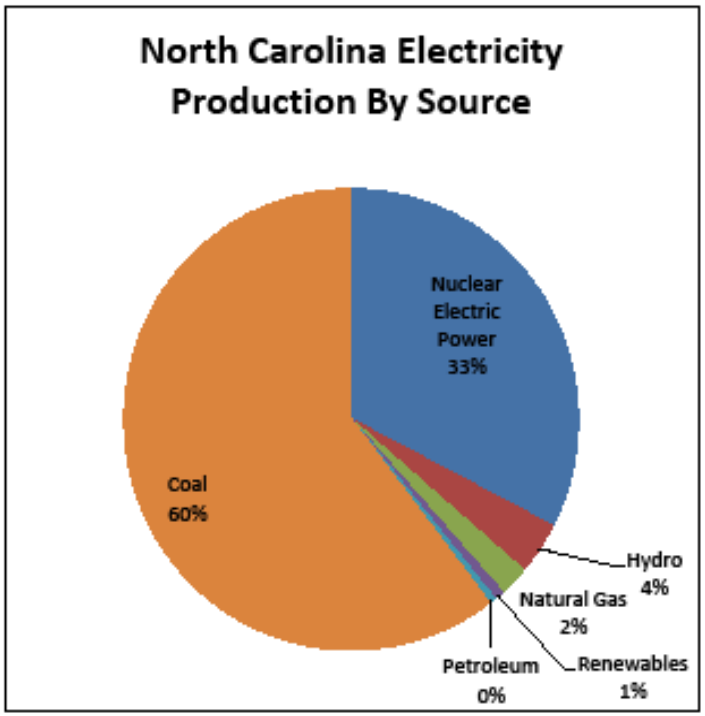
Energy Efficiency	Potential-2020	Policies	Price	Pollutants-2020	People
Building Codes / HP New Buildings	Reduce annual primary energy consumption by up to 13.7 trillion BTUs	-Adopt building codes that leverage all cost effective efficiency opportunities -Support codes that encourage compliance based on fossil fuel and/or GHG emission budget (*see Efficiency Appendix for more information) -Promote improved building code compliance - Promote building code training EE programs; code compliance is the lowest hanging fruit. As codes improve, the savings opportunities will increase. -Encourage municipalities to adopt more aggressive local codes.	Cost of Saved Energy Variable ($0.0 – $7.0 MBTU)	Reduce CO2 emissions by up to 1.0 million metric tons (MMT)	Unknown.
Appliance Standards	Reduce annual primary energy consumption by up to 11.4 trillion BTUs	-Support stricter efficiency appliance and equipment standards for both federally-regulated and non federally regulated appliances (e.g. washing machines) -Enforce appliance and equipment standards - Appliance energy and GHG emissions labels	Cost of Saved Energy Variable ($0.0 – $ 5.0 MBTU)	Reduce CO2 emissions by up to 0.8 million metric tons (MMT)	Unknown.

Matrix: Energy Efficiency

Energy Efficiency	Potential- 2020	Policies	Price	Pollutants- 2020	People
Natural gas energy efficiency programs	Potential funding of cost effective programs, 0.5% to 1.5 % of retail deliveries Potential savings on NC retail deliveries approximately 10-30 million therms of natural gas or $12 - $36 million annually, based on the market value of natural gas	-Continue to grow natural gas energy efficiency (EE) programs to increase the scope and depth of the program portfolio's total energy savings -Align the financial interest of utilities to promote energy efficiency programs -Ensure programs address short and long term savings goals including all direct savings programs (i.e. appliance rebates, whole-house retrofits) and non-direct savings programs (i.e. education and training) -Encourage coordination between electric and gas utilities that recognizes program synergies and maximizes primary fuel and emissions savings	Funding levels of EE program savings will vary depending on the size and type of residential, commercial, and/or industrial programs	Potential direct savings from gas EE programs: Saving 1% of retail deliveries would reduce CO2 emissions approximately to 1 million metric tons (MMT) annually by 2020	Job growth for energy efficiency and green companies would strengthen as more NC residents and businesses identified the energy savings potential.

Energy Supply

1. Increase use of natural gas for electricity production



Natural gas Combined Cycle power plants are:
(1) 40%+ more efficient than coal while
(2) emitting 60% fewer carbon dioxide emissions

Energy Supply

1. Increase use of natural gas for electricity production

Increased solar and wind power generation will create more variability in the supply of electricity. Natural gas electricity generation is an effective reserve given quick start-up, low capital costs, high efficiencies and low carbon intensity.

Energy Supply

1. Increase use of natural gas for electricity production
2. Continued supply of cost-effective clean natural gas

EXHIBIT 4: COMBUSTION EMISSIONS
(POUNDS/BILLION BTU OF ENERGY INPUT)

Air Pollutant	Combusted Source		
	Natural Gas	Oil	Coal
Carbon dioxide (CO_2)	117,000	164,000	208,000
Carbon monoxide (CO)	40	33	208
Nitrogen oxides (NO_x)	92	448	457
Sulfur dioxide (SO_2)	0.6	1,122	2,591
Particulates (PM)	7.0	84	2,744
Formaldehyde	0.750	0.220	0.221
Mercury (Hg)	0.000	0.007	0.016

Sources: EIA, 1998

Energy Supply

1. Increase use of natural gas for electricity production
2. Continued supply of cost-effective clean natural gas

The North Carolina Geological Survey has identified commercial quality quantities from two geological regions:

(1)The Mesozoic basins exposed in the Piedmont or beneath the Atlantic Coastal Plain, and
(2) The Atlantic Outer Continental Shelf (AOCS)

Matrix: Energy Supply

Energy Supply	Current Portfolio	Optimal 2015	Optimal 2020	Policies	Price	Pollutants-2020	People
Natural Gas Combined Cycle (NGCC) Power Plants for Electricity Generation	3,129,437 MWh (single cycle)	Up to 12,072,837 MWh, reducing fossil fuel use by up to 34 trillion BTUs annually (116 trillion BTUs of avoided coal use – 82 trillion BTUs of increased natural gas use)	Up to 21,016,237 MWh, reducing fossil fuel use by up to 61 trillion BTUs annually (202 trillion BTUs of avoided coal use – 141 trillion BTUs of increased natural gas use)	*-It is important to ensure system wide fossil fuel and carbon reduction targets, not sector specific targets which would penalize electric utilities for building natural gas power plants* -Majority of this capacity is planned by Duke and Progress Energy over next 5 years -Existing NC Clean Smokestacks Act supports retiring old coal plants and building state-of-the-art NGCC plants	According to a Progress Energy press release, it will cost roughly $950/kW if the new plants are located at decommissioned coal plants to take advantage of existing infrastructure	Reduce CO2 emissions by up to 11.25 million metric tons (MMT) Compared to coal – it would decrease mercury, sulfur-dioxides and nitrogen oxides by nearly 100%.	Intermittent Construction Jobs-estimated at about 500/GW of capacity
Natural Gas	-Pursue in-state exploration for conventional and non-conventional natural gas beginning in high potential geological regions identified by North Carolina Geological Survey (Mesozoic basins exposed in the Piedmont or beneath the Atlantic Coastal Plain, and the Atlantic Outer Continental Shelf (AOCS))						

Transportation

1. Natural Gas Vehicles

Up to 25% Reduction in CO2 Emissions

Natural gas vehicles can be a key tool toward reducing local emissions in North Carolina's nonattainment areas and increasing jobs.

Cummings Engines - Rocky Mount

Thomas Built Buses – High Point

Freightliner – Mount Holly

EMISSIONS CHARACTERISTICS*

Actual emissions will vary with engine design; these numbers reflect the potential reductions offered by compressed natural gas, relative to conventional gasoline.

- Reductions in carbon monoxide emissions of 90 to 97 percent, and reductions in carbon dioxide emissions of 25 percent.
- Reductions in nitrogen oxide emissions of 35 to 60 percent.
- Potential reductions in nonmethane hydrocarbon emissions of 50 to 75 percent.
- Fewer toxic and carcinogenic pollutants, and little to no particulate matter produced.
- No evaporative emissions in dedicated engines (such as those associated with gasoline or diesel).

Matrix: Transportation

Transportation /Other	Potential- 2020	Policies	Price	Pollutants - 2020	People
Natural Gas Vehicles	Reduce annual petroleum consumption by up to 285 million gallons of diesel and gasoline (approximately 70,000 vehicles) by using 34 trillion BTUs of natural gas annually for transportation	-Provide incentives for the purchase and use of large haul and fleet vehicles -Promote production by original equipment manufacturers and conversion of vehicles to natural gas -Provide incentives for fuel pumps and filling stations -Promote fleet expansion -Support and build on recently introduced alternative fuel legislation - Align the financial interest of the utilities to promote natural gas vehicle infrastructure development	Varied; the cost of a compressed natural gas vehicle or aftermarket kit is offset by lower fuel costs over the life of the vehicle.	Reduce CO2 emissions by up to 0.5 million metric tons (MMT)	Green jobs in vehicle and engine manufacturing, job growth for NG fueling station installations and conversions.

Summary

1. Promote energy efficiency
   - Combined heat & power
   - Improved buildings and building systems
   - Increased use of natural gas
2. Promote low carbon energy supply
   - Efficient combined cycle gas electricity production
   - Ensure affordable gas supply with in-state exploration
3. Promote low carbon transportation use
   - Natural gas infrastructure

Appendix

Efficiency Appendix

Energy savings and emissions reductions were calculated using national figures extrapolated for North Carolina. The first phase analysis serves to demonstrate what is possible with aggressive policies and programs. Residential and commercial efficiency savings (DSM, retrofit, codes and appliances) are derived from improved building envelopes (attic, foundation, wall insulation), duct system sealing, and direct use of gas space and water heating equipment. Savings do not include electricity or other fuel (e.g. oil) energy savings unless there is fuel switching (e.g. electric water heater for gas water heater). Despite the immense potential for cost-effective energy and carbon reductions, efficiency improvements are significantly challenged by upfront capital costs. To be successful, efficiency improvements must offer a positive net present value (NPV).

Efficiency Appendix

Combined Heat & Power resources used to populate matrix

- Combined Heat and Power- Effective Energy Solutions for a Sustainable Future: 2008 Oak Ridge National Lab
- Energy Efficiency Opportunities in North Carolina: Draft Report Findings: 2010 Presentation by ACEEE to NC EPC
- EIA Table S1. Energy Consumption Estimates by Source and End-Use Sector, 2007
- EPA eGRID2007
- Gas Technology Institute Research and Analysis

Efficiency Appendix

All other efficiency rows (e.g. Building Retrofits) resources used to populate matrix

- Natural Gas End Use- A Vision for Today and the Future: 2009 American Gas Foundation
- Unlocking Energy Efficiency in the U.S. Economy: 2009 McKinsey & Company
- EIA Table S1. Energy Consumption Estimates by Source and End-Use Sector, 2007
- EPA eGRID2007
- Gas Technology Institute Research and Analysis

Efficiency Appendix

*Building Codes continued

- California's Title 24 building code offers both prescriptive and performance compliance paths
- It is typically more cost-effective for the builder to use the performance path and trade efficiency measures depending on preferences
- Recognizing the primary energy implications, under the residential portion of Title 24, electric resistance space heat is allowed only under certain exceptions (e.g. no gas service); however, once exceptions are met, designers must use electric-only prescriptive path upon which improved envelope and HVAC features are required to bring electric home energy consumption in line with standard design (gas appliances).
- In part due to Title 24, California has over 70% gas space heat, while North Carolina has only 25% (U.S. Average 50%).

Supply Appendix

Natural Gas Supply and Combined Cycle resources used to populate matrix

- Eastern Wind Integration and Transmission Study: 2010 National Renewable Energy Laboratory
- Exelon 2020- A Low Carbon Roadmap: 2009 Exelon
- Progress Energy Carolinas plans to shut down coal-fired power plant: 2009 Progress Energy Press Release
- New Natural Gas Generation Q & A: Duke Energy Website
- Natural Gas and Oil in North Carolina: 2009 North Carolina Geological Survey
- EIA Table S1. Energy Consumption Estimates by Source and End-Use Sector, 2007
- EPA eGRID2007
- Gas Technology Institute Research and Analysis

Transportation Appendix

Transportation resources used to populate matrix

- Natural Gas as a Transportation Fuel- Availability, Benefits, and Barriers to Adoption: 2010 Piedmont Presentation to NC EPC (see pages 13-16 for further policy issues)
- Alternative Fuels Policy: 2010 NC Solar Center presentation to NC EPC
- Natural Gas End Use- A Vision for Today and the Future: 2009 American Gas Foundation
- NGV America Website- About Natural Gas Vehicles Page
- EIA Table S1. Energy Consumption Estimates by Source and End-Use Sector, 2007
- EPA eGRID2007
- Gas Technology Institute Research and Analysis