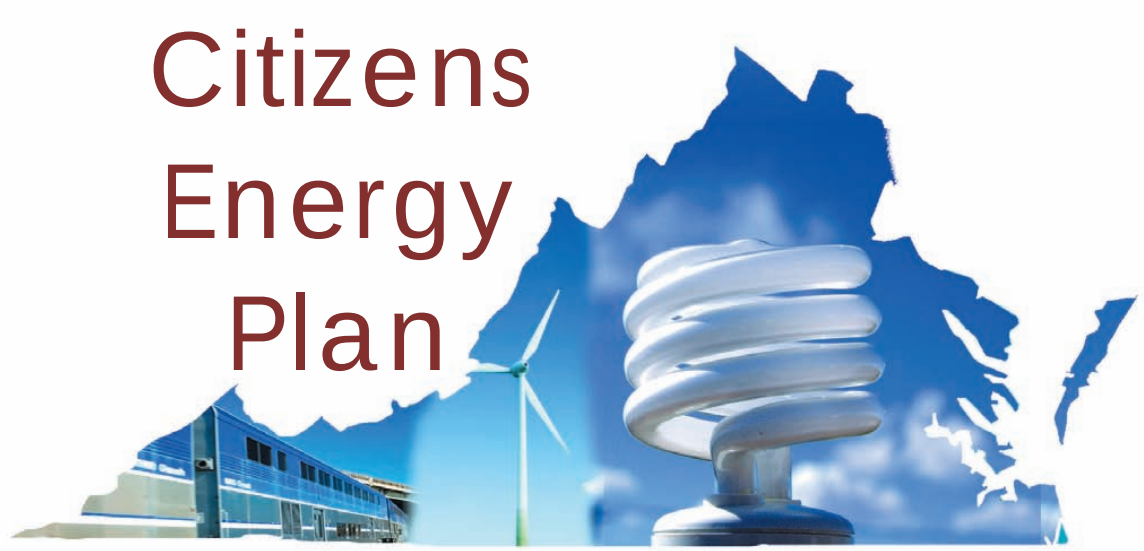
Citizens Energy Plan



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Virginia Chapter Sierra Club

The Sierra Club's members and supporters are more than 1.3 million of your friends and neighbors. Inspired by nature, we work together to protect our communities and the planet. The Sierra Club is America's oldest, largest and most influential grassroots environmental organization. With more than 17,000 members, the Virginia Chapter of Sierra Club places priority on promoting smart energy solutions to fight global warming, protecting the Commonwealth of Virginia's wild legacy, and making our communities safer and healthier places for all of us.

The Citizens Energy Plan for Virginia

was prepared in 2007 by members of the Virginia Chapter of the Sierra Club's Energy Committee and staff, with primary contributions from:

- Dr. Richard Ball, Energy Chair
- Brooks Cressman, Conservation Chair
- Roger Diedrich, Smart Growth and Transportation Chair
- Joshua Low, Organizer
- Barbara Null, Editor

Additional contributors:

- Christopher Carney
- Dr. Ana Prados
- Ross Shearer

To view this report online, visit the Virginia Chapter's website at www.virginia.sierraclub.org.

Virginia Chapter Sierra Club
422 East Franklin Street, Room 302
Richmond, VA 23219
Contact Michael Town, (804) 225-9113 Ext. 102

Introduction

Scientific consensus affirms global warming is occurring and that it is primarily caused by the use of such fossil fuels as coal and oil. Assessments from the UN's Intergovernmental Panel on Climate Change (IPCC) predict that unchecked higher temperatures, rising sea levels and more frequent extreme weather phenomena caused by global warming pose some of the most significant threats faced by humanity.[1]

While global warming is caused by human action, the worst effects can be forestalled if sufficient action is taken to cut emissions. This is a significant challenge, requiring the replacement of fossil fuels with renewable energy sources and the redesign of buildings, systems, and communities to use energy more efficiently.

Virginia's economy currently relies heavily on fossil fuels and lags other states in curbing greenhouse gas emissions. Yet, during the study for this Citizens Energy Plan (CEP), the Virginia Chapter Sierra Club found the state has considerable potential for efficiency and renewables.

Virginia could reduce carbon dioxide emissions on an average of two percent per year as early as 2030, putting us on a path to reach 80 percent reduction by 2050. The CEP projects a nearly complete phase-out of power generated from coal by 2030.

With our legacy of ingenuity and commitment, Virginia is capable of meeting this challenge, but action will be needed by government, citizens, and business alike. As the federal government moves toward carbon regulation, those states currently enacting progressive energy policies will realize competitive advantage in the future and be better able to support growth and provide high standards of living to their citizens.

The CEP recommends Virginians immediately take action against global warming to help secure our economy, to provide a clean and hopeful future for our children, and to reduce future damage to the state from rising sea levels and changing climate.

In this report, the Sierra Club offers Virginia citizens a vision for a new and clean energy future by:

- Explaining impacts of the state's current energy use
- Presenting alternatives with the most potential for Virginia
- Detailing what to include in a sustainable energy plan

Global Warming in Virginia

Virginia is particularly vulnerable to harm from the sea level rise, extreme high tides, and more powerful coastal storms, as predicted by the IPCC assessment. The panel's figures for sea level rise of 7 to 23 inches by 2100 is compounded by the existing coastal subsidence rates of five to six inches per century.[1]

The impact to Virginia, particularly in coastal regions, will be substantial. Sea level rise will lead to increased wetland loss in the Chesapeake Bay. Up to 21 percent of the remaining wetlands in the mid-Atlantic region are at risk of inundation between 2000 and 2100.[2]

A recent study examining the vulnerability of Hampton Roads — Chesapeake, Norfolk, Portsmouth, Suffolk, Virginia Beach, Newport News, and Williamsburg — found "future sea level rise, population growth, and poorly planned development will result in significantly greater risk of storm-surge flooding to people in this area."[3]

A 1991 Federal Emergency Management Agency study estimated expected annual flood damage by the year 2100 to increase by 36 to 58 percent for a one-foot rise in sea level, and by 102 to 200 percent for a three-foot rise.[4] Current estimates of losses may be higher.

Models indicate significant average temperature increases in the region, which, if accurate, could result in increased respiratory ailments and proliferation of human and agricultural pests requiring increased spraying. More specific study for Virginia is needed.

Clearly, Virginia will be impacted by global warming economically and ecologically. We will see a loss of economic opportunity if other areas take the lead in developing solutions. These factors provide a basis for action.

Energy Supply and Demand

Virginia's Energy Sources

Virginia's economy, like that of the U.S. overall, relies heavily on fossil fuels, with about 80 percent of our energy derived from coal, oil and natural gas. Of the electricity generated in the state, 58 percent is derived from fossil fuels (50 percent coal), 36 percent from nuclear power, and 6 percent from hydroelectric, biomass and other renewables.

More than 80 percent of coal consumed in the state is used to produce electricity. Since coal is the fossil fuel with the largest carbon footprint, electrical generation is currently a major contributor to global warming gases.

In 2005, the residential sector used 25 percent of the total energy consumed in Virginia, the commercial sector 23 percent, and the industrial sector approximately 23 percent. The transportation sector consumed the most, accounting for nearly 30 percent of total energy use in the state.

Fuel Types

Production and combustion of coal results in the largest environmental impacts of all the fossil fuels, including land degradation, water pollution, air pollution and carbon dioxide emissions. Technology for capturing and sequestering carbon dioxide is expensive and unproven. Retrofitting existing plants could double the cost of electric power. Since coal combustion plants are essentially incompatible with achievement of global warming mitigation and their retrofit is unlikely, new coal plants should not be built.

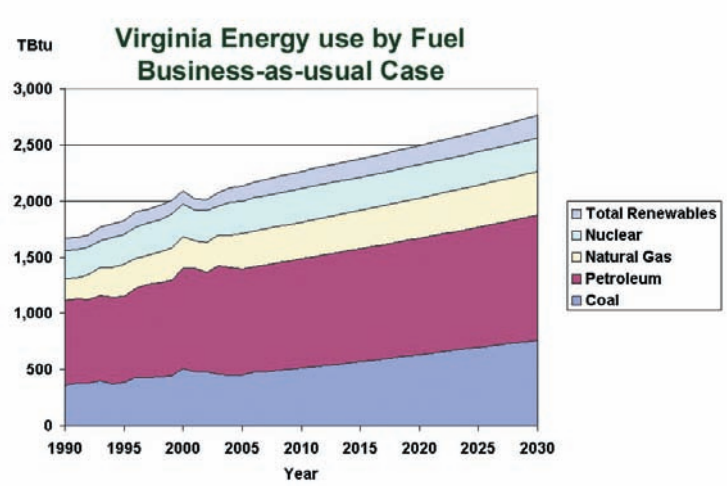
Natural gas has 63 percent the carbon content of coal and 80 percent that of petroleum. Natural gas has an additional advantage over coal when used in highly efficient combined cycle gas turbines. However, the import of natural gas by Liquefied Natural Gas tanker is energy intensive, which reduces the global advantage of natural gas.

While the use of petroleum products for transportation is likely to continue for the near future, petroleum for electrical generation and for heating residential and commercial buildings is expected to decline due to the high price of oil.

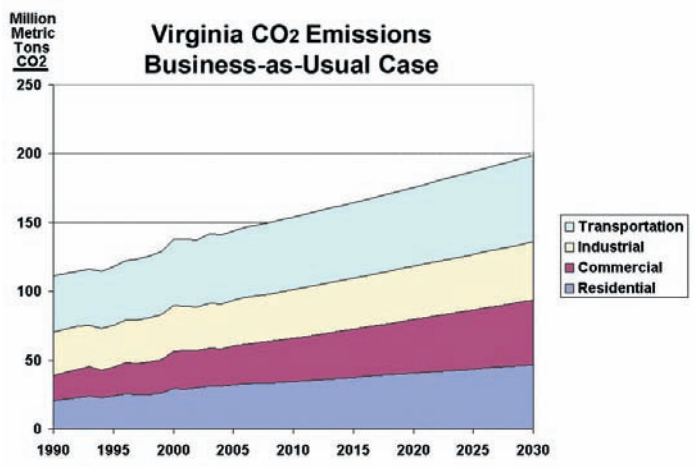
Nuclear plants are assumed to continue to produce electrical power at the 2005 level in both the Business as Usual and our Citizens Energy Plan projections. Though the Sierra Club does not endorse current forms of nuclear power, the CEP assumes these plants will operate until a viable, safe, clean alternative exists.

Virginia's Energy Future Without Climate Action

To determine Virginia's contribution to global warming if fossil fuel and energy use follows current trends (Business as Usual [BAU]), we used publicly accepted sources of data to project current consumption rates to the year 2030.[5] The projection considers the impact of population growth and pricing trends. Under this Business as Usual (BAU) approach, we project Virginia's energy use will continue to grow steadily through 2030 as indicated in the chart below.



In summary, by 2030, total growth in energy consumption is 31 percent. The increase comes mainly from the residential, commercial and transportation sectors, driven by a 30 percent increase in the state's population. While consumption of renewable energy remains close to existing levels, that of fossil fuel grows strongly, particularly for coal and petroleum. Coal consumption in particular increases 68 percent, due to construction of new coal power plants in Virginia and elsewhere to meet electricity demand. The resulting overall growth in carbon emissions of 32 percent will further contribute to the damaging effects of climate change and ocean acidification.



Citizens Energy Plan for Virginia

Our vision for a new energy future integrates energy conservation, more efficient energy use and significant substitution of renewable energy sources for fossil fuel based energy. Conservation and energy efficiency are crucial. During the period of this projection, it is not plausible to develop or acquire enough renewable energy in Virginia to replace the fossil and nuclear sources currently in use. Efficiency and conservation offer immediate opportunities. Little has been done in the past to reduce consumption, in part because Virginia has had low cost electricity.

Conservation

Conservation is primarily a result of individual lifestyle choices that result in reduced energy use. Examples of behaviors an individual can choose to reduce his or her energy consumption are included in Recommendations on page 11.

Energy Efficiency

Efficiency may include new technology, or simply a redesign to minimize energy use. Either case may require financial investment, which is often recouped over time through savings in energy costs — a payback period.

Cost comparisons of these investments should include such environmental benefits as the decrease in greenhouse gas emissions. Some of the more promising efficiency measures follow:

• Green Buildings

Consider life cycle costs when planning a new building. Increase energy efficiency through better siting, design, materials, operation, and maintenance. Green buildings use energy, water, and materials more efficiently, reducing their impact on the environment and public health. While the range of potential savings is broad, 30 percent improvement over standard construction is a common result.[6]

Existing homes and commercial buildings offer many cost-effective options for improvements with manageable payback periods. Energy audits can be conducted to identify the most cost-effective measures for existing buildings.

In our CEP projections we assume a number of efficiency measures have been applied to new and existing residential and commercial buildings and equipment. These account for substantial energy consumption savings, including renewable energy technologies that provide additional energy savings:

• Ground-source (aka geothermal) heat pump

• Solar thermal energy to heat water and, in the future, to provide supplementary space heating and cooling. Active solar thermal (water heating) is already a cost effective and affordable option for household hot water and heated pools.

• Smart Growth

This design of compact communities has a mix of uses such as residences, shopping, entertainment, recreation, education, and employment in a walkable, bikeable, town-style, attractive design. These communities are located along regional transit hubs — rail and bus — which maximize the use of existing infrastructure.

Such communities provide a wider range of transportation choices, giving residents convenient alternatives to car trips and facilitating access to mass transit for wider travel.

Compact development requires less energy consumption in both construction and occupancy of buildings. It provides a high quality of life, health benefits, stronger sense of community and it considerably reduces the use of transportation fuels without sacrifice. In Arlington's Rosslyn-Ballston corridor, for example, nearly 50 percent of corridor residents use transit to commute, contributing to significant reductions in emissions from single occupancy vehicles.

• Transportation

Transportation generates up to 30 percent of greenhouse gas emissions in the U.S. The CEP considers three approaches to reductions:

• Mileage efficiency improvements for vehicles

• Reductions in per-capita miles traveled

• Substitution of biofuels for fossil fuel

In addition, we assume a partial mode shift to rail for freight carriage. Technology exists today to more than double the average mpg for autos and light trucks. CEP assumes achieving 42.5 mpg fleetwide by 2030. This technology may eventually yield to all-electric vehicles eliminating the need for liquid fuels.

Smart growth would shift trips from autos to other modes, reducing vehicle miles traveled (VMT) by five percent by 2020 and by 10 percent by 2030. Use of rail for inter-city passenger travel and freight movement is vastly more efficient and provides considerable emission reduction compared to short-distance air travel or truck transport for freight.

These changes, combined with use of biofuels, result in a 26 percent carbon dioxide emissions reduction over the CEP period.

• Appliances

Household appliances, such as refrigerators, furnaces and air conditioners, water heaters, washer-dryers and light bulbs, are continually improving, but there is room for considerable growth, and better standards are suggested.

Industrial and Agricultural Processes provide substantial potential for energy savings, but we have found it difficult to provide quantitative analysis and insight, therefore we make no claims for such reductions in our prorjection.

• The Public Sector

Programs such as Cool Communities, as advocated by Sierra Club Groups throughout Virginia, focus on measures in the public sector, and include many of the factors already discussed. What is different is that the approaches to implement savings are often driven by politics as well as finance. Also, because governments can borrow at lower interest rates for longer periods of time, more up-front costly measures can be justified and recouped by the energy savings.

Initially, these programs cover vehicle fleets, buildings, and renewable energy purchases by governments. Once municipalities have made these changes, we expect them to encourage the private sector to take similar steps.

Renewables

A number of renewable sources and technologies could become important by 2030 as performance and economics of existing technologies improve and new technologies emerge. To make CEP projections concrete, we focus on only four sources for which viable technologies already exist —wind, solar (PV), solar thermal, and biofuels.[8] If any of these sources do not capture a large market, it is likely other technologies and methods of energy conservation will emerge to take their places. These choices should be viewed as representative of a larger set of options.

• Wind

Wind turbines have made enormous leaps in efficiency and size over the last two decades. Between 2010 and 2015 wind power could supply 400 megawatts of power onshore in Virginia, based on current technology and transmission infrastructure. By 2025 we assume wind could produce 3,000 MW with the development of off-shore wind resources, increasing to almost 5,000 MW by 2030. Wind turbines should have appropriate siting standards, minimizing damage to vulnerable lands and animals.

CEP projections use generation from natural gas turbines to balance the natural variability of wind energy generation. By the 2020s it is likely other methods of balancing wind energy will become economically feasible.

Capacity of existing natural gas power plants in Virginia was utilized only 14 percent in 2005. It appears, therefore, it should be possible to expand natural gas generation without constructing new plants. The CEP does not assume use of liquefied natural gas (LNG) due to associated energy costs of compression and shipping.

• Solar

Virginia has the potential for 11,700 to 13,000 MW from solar, assuming solar was installed on all suitable rooftops.The cost of solar Photovoltaic (PV), while historically high, is dropping, and projections show that by 2020 the cost will have dropped considerably, making wider adoption likely. CEP projections assume that between 2025 and 2030, 5,000 MWh will be installed.

• Biofuels

Biofuels include solid, liquid, or gaseous fuel derived from, or consisting of, plant material. Liquid fuels such as ethanol, biobutanol and biodiesel, are generally used to supplement gasoline and diesel fuels respectively. Such use is assumed in the CEP. Biofuels are considered renewable when sustainably grown:

- Planted on existing agricultural land
- Carbon released upon burning is returned to the next crop
- Show a net gain in energy beyond that used to grow and process them

These requirements place limits on the production of these fuels.

Virginia has high potential for producing cellulosic ethanol, which has a higher energy return than corn ethanol. Extensive fallow land in Southwest Virginia is available for production of prairie grass feedstock for cellulosic ethanol.

Biodiesel, a promising biofuel, is created from microalgae, waste oil from soybean processing, discarded oil from deep fryers, and even leftover fat from animal processing.

Producing biodiesel from microalgae in closed systems, called photobioreactors, is currently under development. Photobioreactors use carbon dioxide emissions from coal fired power plants as algae feedstock. Microalgae require only one percent of the water traditional agriculture requires, while producing 30 to100 times the yield of soybean based biodiesel. Yields approach 10,000 gallons per acre.[9]

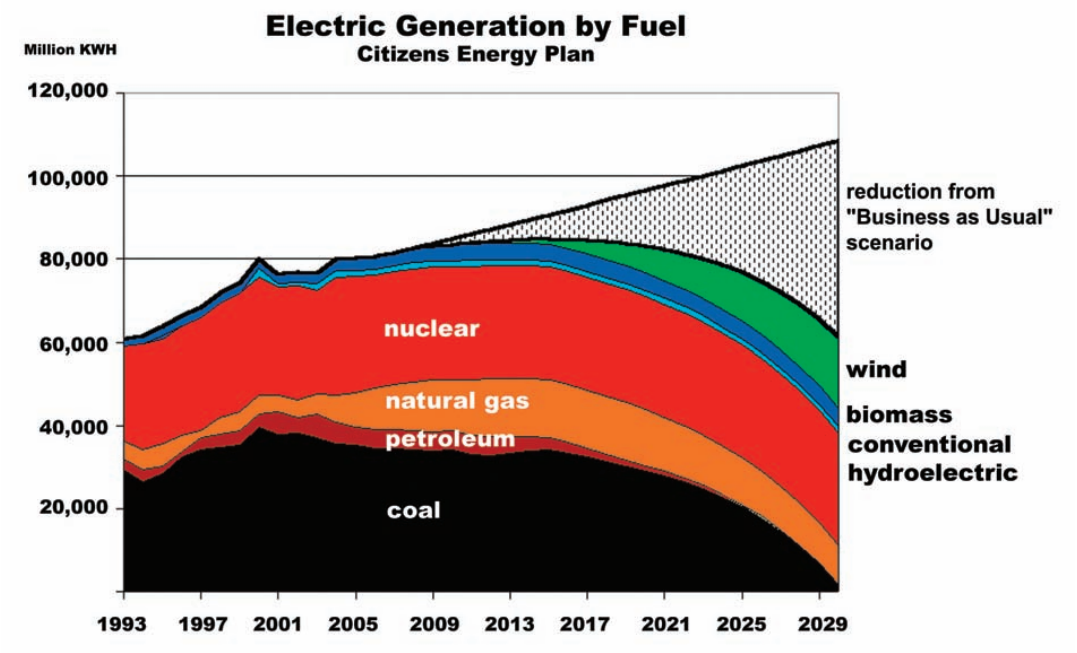
Using about 520,000 acres (more than two million are unused and available,) Virginia has the potential to provide 10 percent of its current liquid fuel consumption. This would retain in Virginia $1.1 billion of the $11 billion spent on imported gasoline and diesel.

Distributed generation and storage

Distributed generation and storage refers to both home based generators such as solar (PV) panels, small turbines, passive solar heating, as well as community generators and storage technology such as large utility scale storage batteries. New technology includes small-scale combined heat and power (CHP) systems and micro-turbines at commercial facilities. If these technologies were widely and strategically distributed, self-reliant micro-grids could be created. They could continue to serve customers during grid power outages and help stabilize and improve reliability of the grid. This is a subject for future study.

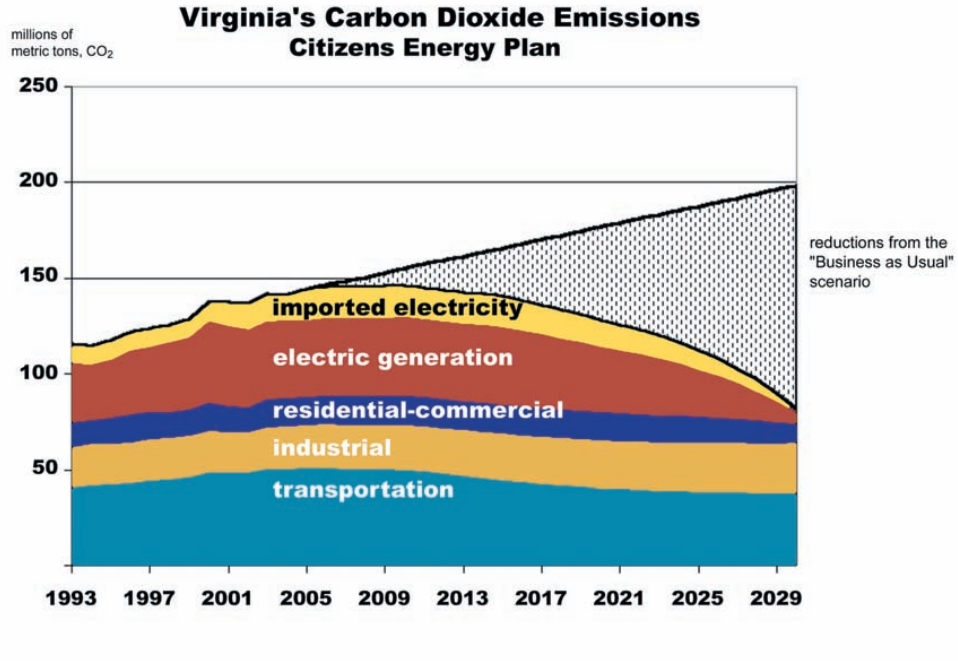
Results

The projected impact of implementing energy solutions described in the CEP is indicated in the chart and table below. Total energy use is reduced 14 percent by 2020 over the Business as Usual approach. By 2030 it is reduced by 27 percent. In absolute terms, energy use is reduced by only 5 percent from 2005 levels due to the 30 percent growth in population. However this is offset by a per capita consumption decrease of 56 percent.



Reduced demand for electricity due to efficiencies makes it possible to halt construction of new coal-fired power plants. As renewable sources such as wind energy grow, older (dirtier and less efficient) coal-fired power plants can be phased out.

Reduced per capita energy consumption, closed coal plants, and a huge 400 percent increase in renewable energy achieves a dramatic 43 percent reduction in carbon emissions by 2030 as indicated in the following chart. Because of a lag in policies taking effect, many reductions will occur from 2020 to 2030. As these reductions continue, by 2050 we achieve the 80 percent reduction in carbon emissions believed necessary to keep average temperature rise below 2.4° F, forestalling the worst effects of global warming.



Comparison Results from Business-as-Usual and Citizens Energy Plan Scenarios

Year	Population (millions)	TBtu Consumed		Percent Coal		Percent Renewables		Total CO_2 Million Metric Tons		CO_2 per capita	
		BAU	CEP	BAU	CEP	BAU	CEP	BAU	CEP	BAU	CEP
2005	7.55	2470	2470	18	18	5.4	5.4	144	144	19.1	19.1
2010	8.01	2617	2557	20	17	5.8	6.1	155	146	19.4	18.3
2015	8.47	2763	2537	21	18	5.8	7.3	166	141	19.6	16.6
2020	8.92	2911	2499	22	16	5.8	9.3	177	128	19.8	14.4
2025	9.36	3066	2445	23	13	5.9	13	188	112	20.0	12.0
2030	9.83	3238	2351	23	5.3	6.1	21	199	82	20.2	8.4
%change 2005-2030	30	31	- 5	28	- 71	13	400	38	- 43	6	- 56

Recommended actions

State Government

• Establish statewide targets for at least an 80 percent reduction in carbon dioxide emissions by 2050 and establish an inventory based on the Climate Registry System.

• Establish a Public Benefits Fund to provide financial incentives for conservation and energy efficiency. Establish a program for decentralized residential solar, wind and similar renewable energy production.

• Strengthen mandatory energy efficiency building codes and support local government's enforcement of codes. Encourage and provide support for third-party green building branding programs to encourage sustainable building practices.

• Revamp the State's Transportation Plan and policies to shift funding priorities away from major new highway building and expansion to a more balanced plan with emphasis on:

- Public transit
- Rail for freight, beginning on I-81
- Local support for increased bicycle and pedestrian access

• Tie state funding to policies that will enable local governments to maximize transportation and location efficiency in community design.

• Place a moratorium on new coal and nuclear plants, such as those planned in Wise County and North Anna. Develop plans to phase out existing high-carbon emitters, including the Mirant power plant in Alexandria, as quickly as possible. Stop plans for major new power lines until efficiency and conservation measures are exhausted and demand for new transmission is proven.

Counties and Municipalities

Join the Cool Cities or Cool Counties program, with corresponding commitments to:

• Set targets for carbon pollution reductions, conduct inventories of emissions, and establish monitoring programs.

• Adopt and enforce land-use policies that reduce sprawl, preserve open space and create compact, multi-use walkable communities.

• Buy green power and make county or municipal buildings and fleets energy efficient.

• Provide education and incentives for residents and businesses to reduce energy use and global warming pollution.

Individuals

• Purchase Energy Star appliances and Compact Fluorescent Light bulbs. Turn lights off when not in use.

• Obtain a home energy audit and implement what is affordable.

• If you need a car, choose an efficient model. When buying a home, choose the most efficient option and location possible.

• Bike, walk, ride public transit, carpool and telecommute.

• Choose a diet of locally grown, organic food, and consider a more vegetarian diet.

• Reduce. reuse, recycle, dry on a line, mow motor-less, drink from a refillable container.

These recommendations are just examples of how we can cut our carbon dioxide emissions by about two percent per year. More can be found at www.sierraclub.org/twopercent.

Sources

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3) Kleinosky, L. R., B. Yarnal, and A. Fisher, 2006: Vulnerability of Hampton Roads, Virginia, to storm-surge flooding and sea-level rise. *Natural Hazards*, 39, doi: 10.1007/s11069-006-0004-z, 43-70.

4) FEMA, 1991 : Projected Impact of Relative Sea Level Rise on the National Flood Insurance Program

5) The Business as Usual (BAU) case uses U.S. Energy Information Administration baseline Virginia data from 2003 and trends from EIA's 2007 base-case projections. Residential projections were adjusted using Census Bureau Virginia population data. Virginia is projected to grow about 25 percent faster than the total U.S. The Transportation projection is from a trend in EIA's High World Oil Price Case.

6) All renewable estimates from : *A Study of Increased Use of Renewable Energy Resources in Virginia*. The Virginia Center for Coal and Energy Research, Virginia Polytechnic Institute and State University, Nov 11, 2005

7) Virginia Sustainable Building Network, Annette Osso, 2007

8) Source: US EPA website, http://www.epa.gov/dced/awards/sg_awards_publication_2006.htm

9) Source : Solix Biofuels Inc. 2006.

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422 East Franklin Street, Room 302
Richmond, VA 23219
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