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To: George Givens
From: Stephen A. Smith, Executive Director
Date: January 6, 2009
Re: Energy Recycling Recommendations

This memo outlines the opportunities for North Carolina to legislatively encourage the development of energy recycling technologies as a means to diversify our energy resources, reduce global warming pollution, and recycle energy presently lost through industrial operations. We recommend that the Legislative Commission on Global Climate Change offer proposed language to advance energy recycling as a policy priority for the state. Energy recycling offers an opportunity to put currently wasted energy to work for our economy, and to spark new economic development opportunities in North Carolina.

Energy recycling is a highly cost effective means of producing energy. It is a simple and proven technology that is already widely adopted around the nation, and is applied in both new and existing facilities. Many industries produce significant amounts of waste heat that could be captured and transformed into useable, productive steam, heat, or cooling. The most widely used form of energy recycling technology is combined heat and power (or CHP); North Carolina has over 1,400 MW of CHP systems installed at industrial, educational, government and other locations.[1] Use of CHP technology increases the overall efficiency of fuel use by combining the electricity and thermal (heat) operations to meet the same demand rather than obtaining them from separate sources.

Other forms of energy recycling involve the capture of energy that would normally be wasted; the recovered heat is converted into useful electricity or thermal energy. These other forms of energy recycling include waste heat recovery from facilities such as industrial bakers or secondary steel processing plants and CCHP (combined cooling, heating, and power).[2] Applying these technologies can reduce overall costs to the industrial customers, help meet our state's growing energy demands, and provide power while producing less global warming pollution.

North Carolina needs legislative language that will reduce the barriers to implementation and permitting of energy recycling, and specifically CHP as a power source. Designing a market, in which incentives exist and risks are decreased for the sale of and purchase of all energy recycling systems is necessary. To develop these systems, the legislative barriers to widespread adoption of energy recycling technologies must be addressed. Presently, the barriers to implementation of CHP and other energy recycling systems in the state[3] include but are not limited to:

1. The value of surplus electricity is undervalued due to historical practice.
2. Interconnection standards are insufficiently standardized and retain unnecessary barriers to installation of energy recycling systems.
3. Non-utilities are barred from selling surplus thermal energy.
4. Environmental permitting is perceived to present a barrier to the installation of CHP and other energy recycling systems at existing facilities.

5. Non-utilities are not able to take advantage of the North Carolina Renewable Energy and Energy Efficiency Standard (REPS) as an incentive for energy recycling systems.

Fortunately, many applications of energy recycling use proven technologies and thus present a short-term opportunity to impact the state's energy future. Ramp up of even major systems can occur in less than three years. Expansions of existing systems could occur in less than two years.

Potential impact of energy recycling

In the electric resource model developed for our June 2008 *Cornerstones* report, we estimated that energy recycling could grow to meet 25% of electricity demand by 2030.[4] If this goal were achieved, it would help North Carolina avoid 33 million tons of global warming pollution.

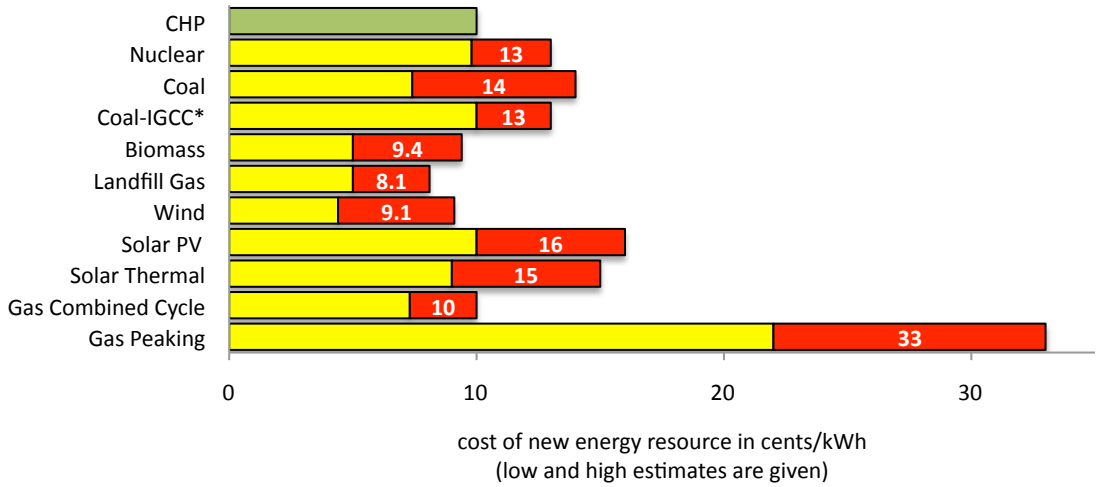
Table 1: Energy Recycling Forecast[5]

	Electricity Supplied (GWh)	Share of Annual Electric Sales	Share of *Today's* Technical Potential
2010	4,204	3%	10%
2015	14,804	10%	35%
2020	25,848	18%	60%
2025	36,579	24%	85%
2030	39,781	25%	93%

Source: Southern Alliance for Clean Energy.

The cost of energy recycling is quite competitive with other energy resources. For example, according to a study completed for the Western Governors Association, there is potential for over 25 GW of electricity to be supplied from CHP projects in its region at a cost of less than 10 cents per kWh.[6] This cost estimate is likely applicable to CHP technologies available in North Carolina as well.

Figure 1: CHP Technology: Cost-effective electric generation option



Sources: *Levelized Cost of Energy Analysis – Version 2.0*, Lazard Management, June 2008 and Western Governors Association, January 2006.
*Cost estimates for Coal-IGCC do not include the cost of carbon capture and storage.

Recommendation 1: Offer market price for electricity

Facilities that invest in energy recycling will receive a relatively low price for electricity that they decide to sell to a North Carolina utility. Regulation of the value paid for electricity generated by non-utilities has historically been focused on protecting utility customers from overpayment. It has not been the policy of North Carolina to establish a price for electricity by non-utilities that encourages the generation of electricity outside the utility system. This explains why there is relatively little momentum behind energy recycling in North Carolina and other states with similar policies.

Currently, those companies that do generate and sell excess electricity receive a rate that is regulated by the North Carolina Utilities Commission. The rate is known as the "avoided cost" or PURPA rate, in recognition of the federal PURPA requirement that utilities purchase power from small generators at a price established by the state regulatory authority.[7] A full understanding of the PURPA rate is quite complex, but the vast majority of the financial value to the generator is established based on the avoided cost of energy; in other words, the seller of electricity to the utility is paid primarily based on the fuel cost savings to the utility – there is very little consideration given to the savings resulting from not constructing new power plants.

The avoided cost rate does not reflect the true value of the excess electricity generated by non-utility sources. Fuel and other variable costs are roughly half the total expenditures of an electric utility. In addition to paying for fuel and variable costs, utility customer rates also cover the capital and relatively non-variable costs of operating the utility. As a result, *the average payment to the generator of energy can be about half the average price of electricity* paid by the average customer for electricity.[8]

In order to promote (rather than simply accept) the generation of efficient electricity from energy recycling or CHP technologies, the state must adopt an explicit policy promoting the development of this resource. One approach we recommend is to adopt the California Market Price Referent approach. California law provides for the commission to "determine the market price of electricity" considering:

- The long-term market price of electricity for fixed price contracts;
- The long-term ownership, operating, and fixed-price fuel costs associated with fixed-price electricity from new generating facilities; and
- The value of different products including base load, peaking, and as-available output.[9]

This "Market Price Referent" approach is specifically applicable to renewable energy and does not constitute implementation of the PURPA rate as discussed above.

In addition to the factors considered in the Market Price Referent approach, energy recycling (and distributed generation in general) provide additional benefits that are not captured in the Market Price Referent or other existing models. Namely, distributing generation so that it is in closer proximity to demand, distribution and transmission line losses may be reduced, providing additional energy savings. Furthermore, these reduced transmission demands help mitigate the need for new transmission infrastructure construction and, in circumstances where Construction Work in Progress funding is offered, will also help avoid customer rate hikes in advance of central power plant construction.

North Carolina could adopt a variant of the "Market Price Referent" approach that would apply to electricity generated in a manner that substantially increases the efficiency of fuel use.[10] Such an approach would increase the price paid for electricity supplied by non-utility sources, thereby making the adoption of CHP technologies more cost-effective.

For example, the California Market Price Referent prices are substantially higher than the corresponding rate schedules offered in North Carolina. In California, a generator providing a consistent "base load" supply would be paid approximately 10 cents per kWh in California compared to approximately 6.1 cents per kWh in North Carolina.

The reason that sellers of electricity to utilities are paid a price that is 65% higher in California than in North Carolina has to do with the methods by which the prices are calculated, and to a far lesser degree any actual difference in costs between the two states.[11] In North Carolina, the majority of the price is determined based on the fuel cost of the existing generation system, including coal and nuclear resources, which have low fuel costs but high capital costs. In contrast, the California approach considers the resource to offset the construction of future power plants exclusively and gives full credit for avoiding the investment. By employing this rate calculation method, California is allowing for the sale of excess electricity to utilities that better reflects the cost to the utility to generate this electricity elsewhere. Such an approach in North Carolina would significantly promote the adoption of recycled energy and CHP technologies.

Recommendation 2: Remove remaining obstacles to interconnection

Interconnection standards should be standardized and designed in such a way as to remove obstacles to the installation and utilization of CHP and other energy recycling technologies.

Interconnection is the ability of a non-utility generator to operate while connected to the electric distribution system. In many circumstances, installers of CHP technologies design their systems to produce the required amount of heat, thereby producing an excess of electricity in the process. When a facility generates excess electricity it provides energy to the grid (what is commonly referred to as "distributed generation"). The interconnection standard employed by the servicing utility can have a significant effect on the financing of distributed generation projects. To encourage the installation of CHP and energy recycling systems, it is important that interconnection standards be favorable to the development of distributed generation and is consistent from utility to utility.

In North Carolina, the June 2008 changes to the interconnection standards were a positive step forward in promoting energy recycling technologies. However, North Carolina could still greatly enhance the ability of these technologies to become widespread. Recommendations for interconnection standard best practices to encourage the development of distributed generation technologies are provided in the October 2008 report *Freeing the Grid*.[12] Several of these recommendations could be adopted by North Carolina to create a more favorable environment recycled energy technology implementation.

- **Consistency in interconnection requirements across utilities**: When interconnection standards vary, the disparity greatly increases the costs for equipment developers, CHP project developers and end users who are trying to deploy energy recycling systems. Interconnection standards must be standardized across all utilities and the state and be predictable to allow for proper cost/benefit analysis of projects and must be applicable to all relevant distributors of electricity in the region. Currently, NCUC interconnection standards do not govern municipal utilities or electric cooperatives. This allows for inconsistencies that will complicate and delay the advancement of energy recycling technologies in North Carolina. To achieve widespread adoption municipalities and electric co-ops must be included in the standardized interconnection standards to ensure uniformity throughout the region.[13]

- **Ensuring energy recycling and CHP technologies are included in utility energy efficiency programs**: Currently, the REPS provides the utilities with substantial flexibility in determining what counts as an energy efficiency measure. Recent energy efficiency program proposals filed by Duke Energy and Progress Energy have largely omitted promotion of energy recycling technologies. North Carolina should ensure that energy recycling technologies are included in a utility's available energy efficiency measures. This could be accomplished by providing statutory encouragement to utilities to develop these technologies, or by providing a standard mandating that they be included up to a set amount.

- **Adopting the Interstate Renewable Energy Council (IREC) model interconnection standards:** The IREC has developed model interconnection standards that are designed to encourage the development of distributed generation technologies including CHP. North Carolina should consider adopting these model standards in their entirety or to the greatest extent possible. If not enacted in their entirety, some of the IREC standards that North Carolina should consider to enhance the improvements already enacted in June 2008 include:
  - Abolishing the utilities' authority to require an external disconnect switch: Although North Carolina's 2008 interconnection standards require utilities to reimburse owners of systems less than 10 kW for the cost of external disconnect switches, the process of securing the necessary agreements can still be prohibitively onerous. Removing this authority would further facilitate the development of energy recycling technologies by streamlining the development process and providing the correct signals to these markets.
  - Reduce unnecessary safety requirements: Prohibiting utilities from requiring unnecessary and expensive safety requirements would further enhance the cost-effectiveness of energy recycling projects. Systems can be pre-tested and certified as safe to provide greater consistency and assurance to the developers of these technologies.

Recommendation 3: Authorize sale of thermal energy (hot water, steam)

In addition to undervaluing electricity produced with CHP or another form of recycled energy, North Carolina prohibits the sale of thermal energy from these systems. In many circumstances, a facility may produce waste heat that cannot be completely utilized on-site (perhaps at the time it is produced or overall). An alternative to producing additional electricity is the sale of this thermal energy, either in the form of heat, hot water, or steam, to neighboring facilities. Allowing such sales would improve the economic feasibility of recycled energy technologies.

Problematically, the sale of energy off-site is generally prohibited under North Carolina law. NCGS § 62-110.2 limits the right to sell electricity, heat or steam to designated utilities within their designated service areas unless the Utilities Commission determines that the utility's service would be inadequate or undependable. This legislation, while protecting the markets of the utilities, severely restricts the applicability of recycled energy technologies in North Carolina. While it is true that many facilities will have use for both the electricity produced and heat captured by CHP operations (for example), many more facilities will be producing excess heat or electricity that could be sold to neighboring industrial or commercial facilities. Changes in North Carolina regulation that allow the sale of excess thermal energy or electricity produced by recycled energy technologies would greatly increase their economic feasibility.

Removal of legislative restrictions on the sale of heat, hot water, or steam could be done by repealing NCGS § 62-110.2 entirely, or by revising the statute to authorize the sale of heat, hot water or steam by a third party non-utility up to a cap based on the quantity of energy sold or the distance that the energy may be transported. We tend to favor an outright repeal, as it is unlikely that a large-scale system would be set up that would effectively create an unregulated private utility as was the concern of this legislation. If the statute is retained, it will be necessary for the North Carolina Utilities Commission to effectively regulate the private contracts for transactions in thermal energy; such regulation may not be a public necessity.

Recommendation 4: Provide sound environmental permitting

Confusion about environmental permitting requirements make industries hesitant to adopt recycled energy technologies out of fear that the installation will trigger costly and time-consuming air quality permitting processes. While recycled energy technologies are compatible with North Carolina's air pollution regulations, there is a need to improve those regulations to ensure that permitting of these technologies is not hindered unnecessarily.

Although recycled energy technologies may increase onsite emissions, they significantly reduce overall emissions through higher efficiency, and waste heat recovery results in zero (or near zero) emissions. Therefore, the permitting process required under North Carolina's Clean Air Act Implementation Plan should recognize the benefits of these technologies and provide for simplified and expedited permitting for their installation.

For example, most CHP installations do not inherently qualify as a major source of air pollution. Typically, a CHP facility with electrical output up to 20 MW will remain below the 250 ton per year threshold for nitrogen oxide (NO_x) emissions that would trigger major source status in North Carolina. However, the Clean Air Act's New Source Review (NSR) process typically requires the installation of state-of-the-art pollution control equipment at the time of construction or major modification. If the installation of recycled energy technology is interpreted as a major modification to a facility with an NSR permit, then these pollution control requirements can effectively make these technologies economically unfeasible.

The Legislature should direct the Department of Environmental Protection to review and revise applicable air pollution standards, to the extent permitted by federal law, to ensure that:

- Installation of a CHP or other type of energy recycling system is treated as a separate unit from any existing facility.
- For systems that do not trigger major source status, a standard or expedited permitting process is available.
- In determining the major source status, the calculation of emissions should consider the reduction of emissions from existing or avoided power plant construction in North Carolina as a result of the efficiency savings.

The necessary regulatory improvements will require a modest revision of North Carolina's State Implementation Plan (SIP) under the Clean Air Act to demonstrate that these procedures will be consistent with progress towards attainment of clean air standards in North Carolina.

Recommendation 5: Make more effective use of the REPS Law

In 2007, the North Carolina General Assembly defined CHP as a renewable energy or energy efficiency resource in the REPS law. However, the North Carolina Utilities Commission has interpreted this law in such a way that it does not maximize its potential to incentivize energy

recycling systems. A significant barrier is that an energy recycling system that is added to an existing industrial or commercial facility is classified as an energy efficiency measure.

As a result, energy recycling upgrades must be implemented within a utility-operated energy efficiency program in order to obtain credit under the REPS law. In contrast, independent installation of a renewable energy system at the same facility would earn renewable energy certificates (RECs) that would have market value under the REPS law.

To resolve this issue, the law could be amended to more clearly define the various permutations of energy recycling (from a variety of industrial sources to the age of the facility) and ensure that each opportunity is given appropriate credit under the RECS law.

Conclusion

The Southern Alliance for Clean Energy would like to offer the above memo for initial consideration of the North Carolina Legislative Commission on Global Climate Change as a priority policy recommendation in the 2009 General Assembly. We believe the opportunities for North Carolina in realizing our energy recycling potentials are numerous. Energy recycling offers a unique step forward in the alternative energy realm, creates new economic ventures stimulating green jobs, and helps diversify our power sources to meet growing demand. These benefits can be achieved relatively quickly compared with the development of other energy technologies. Further, addressing the legislative barriers to development of energy recycling systems such as CHP positions the state well to receive new investments of federal financing for alternative energy projects. Our organization stands ready to assist the state in researching and developing an energy recycling plan that meets North Carolina's unique industrial infrastructure, energy needs, and opportunities.

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[1] Available at http://www.eea-inc.com/chpdata/States/NC.html (accessed 12/16/2008).

[2] Although the scientific and basic engineering concepts behind energy recycling are well established, other applications such as waste heat recovery and combined cooling heating and power (CCHP) remain classified as emerging technologies because of difficulties in establishing a strong market presence. It is also notable that these technologies can be fueled with renewable energy (typically biopower) or operated in a hybrid mode with a solar thermal or other renewable energy resource to maximize efficiency.

[3] We recognize and appreciate the assistance of the North Carolina Solar Center, the North Carolina Sustainable Energy Association, and Recycled Energy Development, LLC in providing assistance in identifying issues and relevant background information.

[4] Southern Alliance for Clean Energy, *Cornerstones: Building a Secure Foundation for North Carolina's Energy Future*, 2008.

[5] Assumptions were made about the feasibility of the implementation rate for energy recycling because there is no estimate for cost-effective potential for combined heat and power (CHP). In addition, technical potential estimates for waste heat recovery or combined cooling heating and power (CCHP) were also unavailable.

Therefore, the numerical basis for our estimate is a consulting firm's estimate that North Carolina has a technical potential for 5,552 MW of combined heat and power projects. We assumed that about 5% of the recent estimate of CHP technical potential could be installed per year. We also assumed that about 25% of energy recycling would be fueled by renewable energy (the balance fueled by natural gas). It should be emphasized that the estimated technical potential is likely underestimated by a significant margin because it did not consider a wide range of technically feasible energy recycling technologies. Thus, although we forecast that by 2030 we would achieve 93% of today's technical potential, the forecast energy resource would actually represent a much smaller fraction of the technical potential in 2030 due to the development of more cost-effective technology as well as growth in the size of the economy.

[6] Western Governors Association, "Combined Heat and Power White Paper," Clean and Diversified Energy Initiative, January 2006. The 10-cent per kWh estimate is obtained from Figure 4 (p. 7) using the real levelized cost of energy (LCOE) including a CHP heat credit assuming gas costs of $11/MMBtu or less.

[7] Public Utility Regulatory Policies Act of 1978 (Public Law 95-617).

[8] This problem is exacerbated when a distributed energy generator tends to supply energy at peak periods, when fuel costs are higher due to use of natural gas "peaker" plants. The full value of the fuel cost savings may not always be reflected in the rates paid to the non-utility electric supplier.

[9] California Public Utilities Code Section 399.15(c).

[10] It would also be practical to adopt this approach as the basis for determining incremental costs under North Carolina's REPS law.

[11] California calculates its rates as follows:

> The MPR model calculates what it would cost to own and operate a base load combined cycle gas turbine (CCGT) power plant over a 10, 15, 20 and 25-year period. The cost of electricity generated by such a power plant, at an assumed technical capacity factor and set of costs, is the proxy for the long-term market price of electricity. To ensure that the MPR represents "the value of different products including base load, peaking, and as-available output," the IOUs apply their IOU-specific Time of Delivery (TOD) profiles to the base load MPR when evaluating RPS renewable facilities.

Public Utilities Commission of the State of California, Resolution E-4214, December 4, 2008.
The North Carolina "biennial determination of avoided cost rates" is estimated based on the November 3, 2008 filing of Progress Energy in Docket No. E-100, Sub 117.

[12] Network for New Energy Choices, *Freeing the Grid: Best and Worst Practices in State Net Metering Policies and Interconnection Standards*, October 2008.

[13] Recently, 23 electric membership corporations jointly submitted their compliance strategy for the Renewable Energy and Efficiency Portfolio Standard (REPS) under the auspices of GreenCo Solutions, Inc. A similar arrangement for development and administration of an interconnection standard for municipal and electric cooperative utilities would be desirable to promote cost-effectiveness.