

## **A Case for a Resilient Future—Clemson at a Crossroad**

A quote from Thomas Wolfe's *Look Homeward Angel*: "O lost, and by the wind grieved, ghost, come back again," reminded me that we as a society are losing what is most precious: we are failing to act in the present for the future of our children and grandchildren and losing our ability to be good stewards of all creatures and life on earth. These ideals are slipping from our grasp as we continue to pollute the planet we inhabit.

We are literally living in a cesspool of smog (LA, Beijing, etc.), polluted water (Flint, MI, etc.) and an atmosphere filling up with potent greenhouse gases - filling up at a rate of 50 gigatons per year<sup>1</sup>. In just 20 years, we will have polluted the planet more so than the previous 250 years since the dawn of the industrial revolution! We have experienced a 1.2 °F increase in global temperature and will see at the least another degree in many of our lifetimes. We have witnessed a one foot sea level rise and will most likely see at least another one to three feet of rise in our lifetime with Miami and New York already threatened<sup>2</sup>. We are watching state-sized ice shelves breaking away into the ocean and the arctic sea becoming navigable. We are now witnessing unprecedented category "6" levels of storm activity caused by warming oceans and complete destruction of massive coral reefs and their dependent fish populations from increasing ocean acidification as the earth tries to balance atmospheric carbon dioxide. The main causes of this mass destruction include burning of fossil fuels especially in heating and cooling applications, transportation, agricultural meat production, and land displacement<sup>1</sup>.

Hurricanes in 2017 have set records for the most category 4 storms in a row showing greater proof of renowned climate scientist Dr. James Hansen's recent publications on the effects of global climate change on the earth's energy imbalance<sup>2</sup>. This brings us to a recent local case in the upstate. Clemson University has recently decided to install a 16 MW Combined Heat and Power (CHP) natural gas plant, constructed and operated by Duke Energy Carolinas at a cost of over \$50 million (details found at SC Public Service Commission website – Docket 2017-47-E)<sup>3</sup>. This all happened while simultaneously backing off an offer by Duke Energy Carolinas to install significant solar power that would have positioned the university and surrounding area of the upstate as one of the greenest university towns in the country. Coupled with an all-electric regional bus system – a solarized energy and transportation system would be yet another milestone for this region. A new potential deal for solar power is back on the table, so let's ALL push harder to make that a reality!

We can choose to stand together as a community and insist that a reasonable solar option be pursued – not over the next decade, but right NOW. Duke Energy has recently installed similar systems in North Carolina now that solar, biomass and wind power costs are in many cases competitive with the cost of natural gas. The pivotal year of 2015-2016 achieved more new installations of solar and wind power plants than natural gas and coal power plants for the first time in history due to a decade of dramatically decreasing prices for both solar and wind technology (see EIA website)<sup>4</sup>. The price of renewable energy is continuing to drop even further, while the cost especially for coal and nuclear power, inversely, are increasing, making them nearly obsolete for new power generation. Battery technology for storage of power is very important to make these renewable energy options work seamlessly and are showing dramatic decreases in cost with new large power plant installations currently taking place in the US<sup>5</sup>. Duke

Energy recently scrapped plans for a nuclear power plant in Florida and now plans to invest \$6 billion in solar power and battery technology instead<sup>6</sup>.

Natural gas is still competitive in some cases with solar power, but the amount of pollution is often as dirty as coal<sup>5</sup> – despite the fact that methane combustion only produces about half of the carbon dioxide as coal. The pollution is primarily due to excessive methane leaks during extraction and transportation and nitrogen oxide emissions from combustion, since both methane and nitrogen oxides are much more potent greenhouse gases than carbon dioxide. Also, ultrafine particle pollution from natural gas power plants is as high as coal causing significant health concern to citizens down wind of the proposed natural gas plant<sup>7</sup>.

Clemson and Duke Energy officials stated to the Clemson City Council that the CHP plant would remove an equivalent of something like 10,000 vehicles from the road when compared to an even dirtier grid powered by older coal and natural gas plants. In fact, however, Clemson University's emissions will increase if the proposed CHP plant is built, despite the pledge to become carbon neutral by 2030. This natural gas power plant will continue emitting harmful greenhouse gases for at least 35 years – 10 years of which Clemson University will be committed to by contract. The decision to build the CHP plant traps the university for decades with expensive infrastructure that includes maintaining antiquated steam pipe systems while heavily investing in new housing complexes that also depend on natural gas. Duke University recently rejected a similarly proposed CHP plant based on the many drawbacks of natural gas – some of which were published in peer-reviewed journals by their own faculty<sup>8</sup>. Duke University has chosen the responsible option by looking for renewable energy solutions in place of fossil fuels. Clemson University should do the same. One solution would be to immediately invest in solar photovoltaics with Duke Energy by using marginal land, parking lot and rooftop installations. Within five years, the price of battery technology will be competitive in SC as it has become today in states with higher energy prices such as California and Hawaii who are already investing into commercial scale battery technology – see graph below.

On the other hand, the university has made significant progress in becoming greener especially in efficiency measures thanks to significant efforts from university facilities energy management and administration who have demanded installation of energy efficient buildings. The architecture building, Lee Hall III serves as an example using a state-of-the-art geothermal system with radiant heating and cooling that could run from solar power and does not require antiquated steam systems. We need to support the university facilities energy management group to aggressively pursue the goal of making the university carbon neutral by 2030 by demanding immediate action for planning the rapid integration of renewable energy options. The university working with Duke Energy need to make the responsible decision by investing into renewable options and help save our environment at the same time – a win-win!

Contact your state representatives, Clemson city and university officials, and local community representatives to demand a better and more resilient future for the upstate by scrapping this proposed natural gas CHP plant and then choosing renewable energy options over extremely harmful and costly fossil fuels. We are at a crossroad; let's take the sustainable path!

# Electrifying Everything

<https://www.economist.com/news/briefing/21726069-no-need-subsidies-higher-volumes-and-better-chemistry-are-causing-costs-plummet-after>

## Watt next?

3

*Battery cost*  
Worldwide, \$/kWh

*Battery energy density*  
Watt-hours per litre



Source: US Department of Energy

Economist.com

- Provided by Dr. Rajendra Singh – see reference above.

### References:

1. <https://www.epa.gov/ghgemissions/global-greenhouse-gas-emissions-data>
2. <https://www.theguardian.com/science/2016/mar/22/sea-level-rise-james-hansen-climate-change-scientist>
3. <https://dms.psc.sc.gov/Web/Dockets/Detail/116205>
4. <https://www.eia.gov/todayinenergy/detail.php?id=30112>
5. <https://futurism.com/solar-power-is-cheaper-but-the-world-is-still-running-on-fossil-fuels/>
6. <https://arstechnica.com/science/2017/08/florida-power-company-exchanging-nuclear-plans-for-solar-plans-cutting-rates/>
7. [http://www.cewep.eu/media/www.cewep.eu/org/med\\_464/905\\_emissioni\\_di\\_polveri\\_fini\\_e\\_ultrafini\\_english\\_2012-04-16.pdf](http://www.cewep.eu/media/www.cewep.eu/org/med_464/905_emissioni_di_polveri_fini_e_ultrafini_english_2012-04-16.pdf)
8. <https://duke.app.box.com/s/b4g84xjw7zv11giw324m93bzi3qlkrf0>

Sincerely,

Terry Walker, Professor of Biosystems Engineering, EEES

Dan Warner, Professor Emeritus of Mathematical Sciences

Kelly Flynn, Associate Coordinator IPM & Sustainable Agriculture Programs, Agricultural and Environmental Sciences

Caye Drapcho, Associate Professor of Biosystems Engineering, EEES

Rajendra Singh, D. Houser Banks Professor, Electrical and Computer Engineering and Automotive Engineering