

Nearshore Wind in the U.S. Southeast: A Technically and Economically Viable Solution for Complying with the EPA’s Clean Power Plan

May 2015

Executive Summary

This white paper examines the potential role that nearshore wind could play in U.S. Southeast (“SE”) Coastal States under the EPA’s proposed Clean Power Plan (“CPP”). Nearshore here is defined as areas that are located on or near the coastline, and SE Coastal States are defined as Virginia, North Carolina, South Carolina, and Georgia. Nearshore wind is compelling in the SE for two reasons. First, wind speeds are within typical ranges for wind economics to make sense, while this is not true for much of the SE inland. Second, nearshore wind is less capital intensive than offshore wind, which could make the cost/integration risk, whether perceived or real, more amenable to utilities in the SE where wind integration would be a new issue.

FTI applied the PLEXOS electricity model to assess whether nearshore wind can play a role in helping states meet EPA’s proposed CPP. The CPP sets state-level emission rate targets from 2020 to 2030 that apply to existing generators. Renewables, such as wind, are one of the four options under the CPP to reduce CO₂ emissions from existing generators.

Our analysis found that nearshore wind presents a technically and economically viable option for SE Coastal States. We project that 1400–2200 MW of new, nearshore wind capacity could be built in the two CPP scenarios modeled.

Introduction

This whitepaper examines the potential for nearshore wind in the SE Coastal States of Virginia, North Carolina, South Carolina, and Georgia under EPA’s proposed CPP. Nearshore wind defined here represents onshore wind farms that are at or near the coastline and experience statistically higher wind speeds than more inland locations.

There currently is little to no wind generation capacity in the four SE Coastal States, which is mainly due to a combination of poor inland wind speeds and a lack of incentives, such as state tax credits, that would make onshore or nearshore wind economically viable under current regulatory and legislative policies. The CPP could change the economics of wind in the SE as states would be forced to comply with CO₂ emission targets.

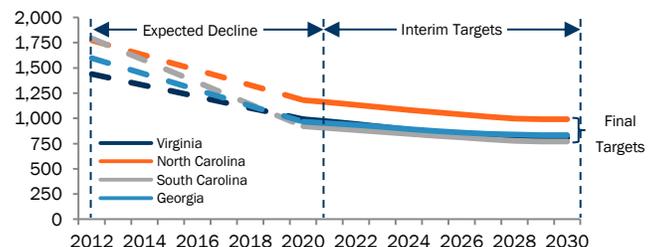
The following describes the EPA’s CPP proposal, the wind technical potential in the SE, and the wind economic potential under the CPP.

EPA’s Clean Power Plan

In June 2014, the U.S. EPA announced the proposed CPP under Section 111(d) of the Clean Air Act. The CPP targets an overall reduction in U.S. CO₂ emissions from existing plants that is equivalent to 30% below 2005 levels by 2030. This overall target is based on a build-up of state-level emission rate targets that begin in 2020 and tighten until a 2030 “final goal” is achieved under Option 1 of the CPP.

EPA has set the state-specific CO₂ emissions rate targets using a Best System of Emissions Reductions (“BSER”) that are based on four “building blocks”. The four building blocks are (1) heat rate improvements, (2) higher utilization of natural gas combined cycle (“NGCC”), (3) expanded use of low- and zero-carbon generation, and (4) increased demand side energy efficiency. Figure 1 shows the CPP emission rate targets for the four SE Coastal States.

Figure 1: CPP Emission Rate Targets for SE Coastal States



Source: EPA

The emission rate calculation considers fossil CO₂ emissions in the numerator and then allows fossil generation to be offset by nuclear and renewable generation and energy efficiency in the denominator as show below:

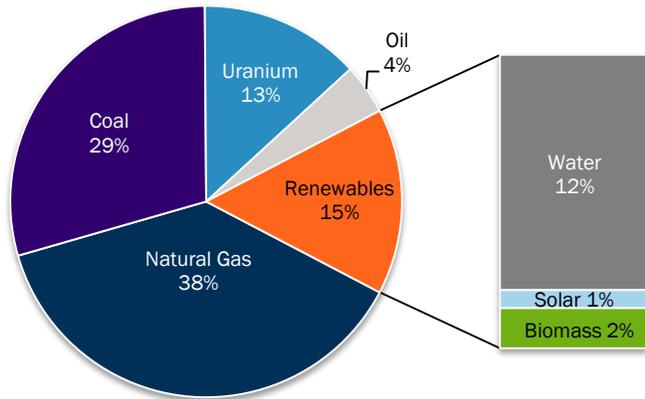
$$\text{State Goal Formula (lb/MWh)} = \frac{\text{Fossil CO}_2 \text{ Emissions}}{\text{Fossil, New Nuclear, and New Renewable Generation} + \text{Energy Efficiency Gains}}$$

New wind in the SE would serve as a potential solution for CPP compliance. The following sections detail its technical and economic viability in the SE.

Nearshore Technical & Economic Potential in SE Coastal States

There currently is little to no operating wind capacity in the Southeast Coast States. Hydropower represents the largest renewable energy source in these states (see Figure 2).

Figure 2: SE Coast States' Capacity Mix by Fuel Type, 2014

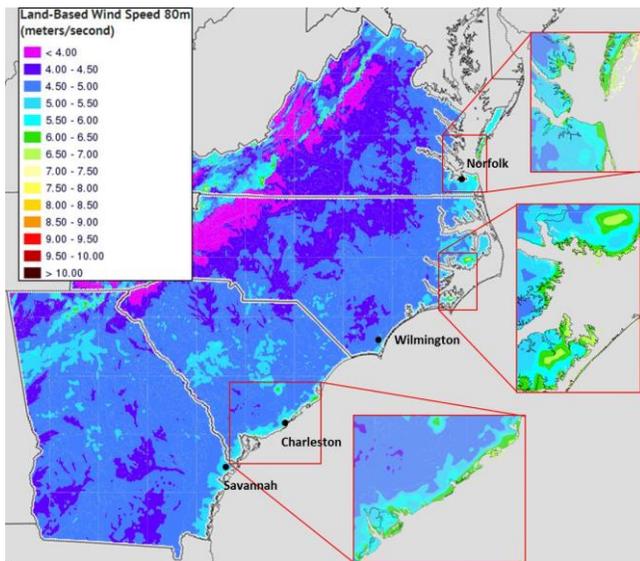


Source: Ventyx Velocity Suite

While the Southeast historically had been considered an area deficient in renewable resources, recent solar installation activities have proven otherwise. During the past five years, Southeast Coast States installed more than 1000 MW of solar electric capacity, mainly due to favorable state tax credits in North Carolina and Georgia.

A similar build-out in wind capacity in the SE could occur as there is sizable technical potential along the coasts where wind speeds exceed 7 meters on average (see Figure 3). Typically, these are speeds where land-based wind becomes economically viable.

Figure 3: Average Annual Wind Speeds, 80 meters



Source: NREL

In North Carolina, there have been almost 1000 MWs of nearshore wind facilities proposed that are in various stages of commercial development as shown in Table 1.

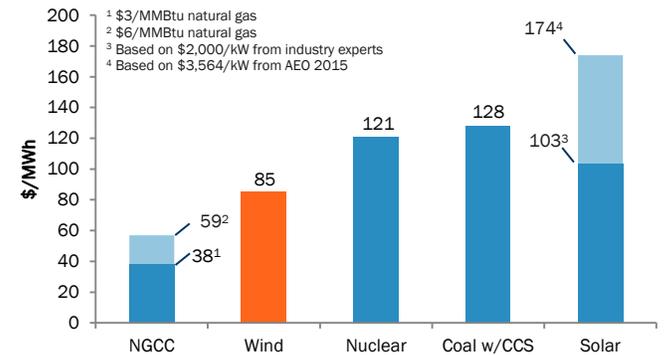
Table 1: Potential Nearshore Wind Projects in the Southeast

Plant Name	Location	Developer	Capacity (MW)	Status
Desert Wind	Elizabeth City	Iberdrola	300	Permitted
Tumbermill Wind	Perquimans & Chowan Counties	Apex	300	Under Development
Hales Lake	Camden & Currituck Counties	Invenergy	300	Proposed
Pantego	Pantego	Invenergy	80	Permitted

Source: Ventyx Velocity Suite

Nearshore wind also is an enticing option in the SE based on levelized costs as shown in Figure 4.

Figure 4: Levelized Cost of New Generation (excluding subsidies)



Source: AEO 2015 and FTI Analysis

Nearshore wind is the lowest cost option among all commercial, zero-carbon technologies by \$20/MWh. At a cost only about \$25/MWh higher than natural gas combined cycle ("NGCC"), nearshore wind could displace NGCC as the technology of choice under a scenario where CO₂ emissions are valued.

CPP Modeling Approach and Findings

FTI used the PLEXOS electricity model to examine the economic potential of nearshore wind under the CPP. Plexos is a capacity expansion and chronological load model that optimizes generation dispatch, unit commitment, and power flow under a range of future fuel price, load growth, regulatory, and technology advancement scenarios. It has both zonal and nodal capabilities and can examine intervals as short as 1-minute over daily, weekly, annual and multi-annual periods.

To understand the range of potential outcomes for nearshore wind, we examined the following three scenarios:

- **Business as Usual (BAU):** existing regulations and legislation continue; EPA proposals are not included.

- **CPP with High Efficiency (CPP_Hi-Eff):** the CPP energy efficiency building block goal is achieved; also, coal units can improve their efficiency by 6% at \$100/kW.
- **CPP with Low Efficiency (CPP_Lo-Eff):** no CPP energy efficiency gains are realized; coal plants are unable to achieve efficiency due to technical and economic reasons.

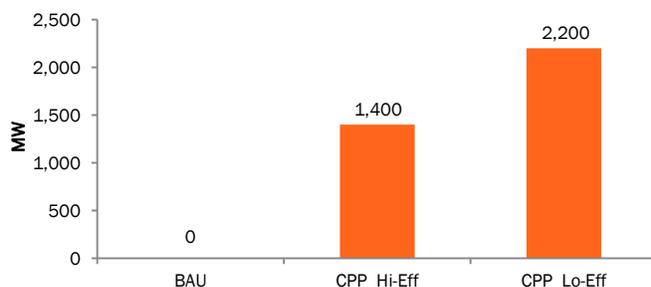
We selected the two CPP scenarios to represent two distinct sides of the CPP debate. There are those who argue that a high efficiency scenario can be achieved and sustained indefinitely. However, others argue that EPA's estimated coal efficiency upgrade potential is overly optimistic and that energy efficiency gains quickly dissipate as part of a 'rebound effect,' which lowers price and increases demand. Regardless, the scenarios present an interesting range under which to assess nearshore wind potential.

FTI made the following major assumptions for these scenarios:

- State-level CPP emission rate limits aggregated and represented as a single SE Coastal State region
- Planning area load forecasts based on FERC 714 and extended to 2035
- Annual Energy Outlook ("AEO") 2015 new unit cost and performance characteristics, except for higher nuclear (\$8,000/kW) and lower solar PV (\$2,000/kW) costs based on market data
- AEO 2015 natural gas and coal price forecasts
- No additional retirements from EPA's Mercury and Air Toxics Standard beyond current announcements
- Annual build limits based on NREL renewable energy technical potential
- All wind new builds in the model will be along the coast and not in mountainous regions in the SE Coastal States, given pushback on building in the Appalachians

The following figures provide the modeling results for the three scenarios. Figure 5 shows that there are 1400-2200 MW of nearshore wind economic potential over the next 20 years in the Southeast under the two CPP scenarios. The CPP_Hi-Eff scenario results in more coal units staying on-line and a reduction in energy demand, thus curtailing the need for additional low-carbon generation that occurs in the CPP_Lo-Eff scenario.

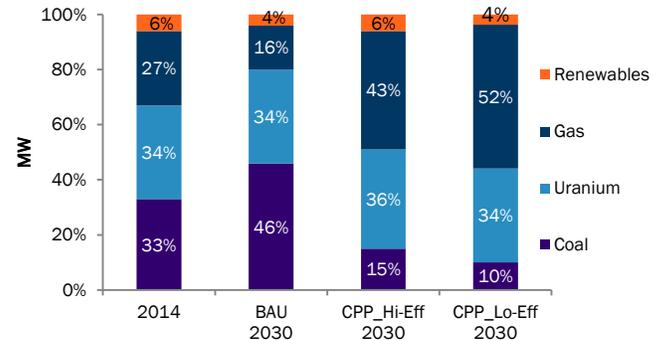
Figure 5: Cumulative SE Nearshore Wind Additions



Source: FTI Analysis

Figure 6 shows how the generation mix by fuel type changes from 2014 to 2030 under the three scenarios. In the BAU, gas prices are forecasted to rise, resulting in higher coal utilization. However, in the CPP scenarios, coal is supplanted by natural gas in order to meet the CO₂ emission rate targets.

Figure 6: Generation Mix by Fuel Type



Source: FTI Analysis

Conclusions

Over the past five years, the Southeast has experienced a surge in renewable activity with more than 1000 MW in cumulative PV solar capacity additions. With the Federal investment tax credits for renewables set to expire at the end of 2016, market participants should begin looking towards other renewable technologies as potential solutions for CPP compliance.

In particular, nearshore wind could play an important role in SE Coastal States. Our modeling indicates that under the CPP, 1400-2200 MW of nearshore wind could be economically built over the next 20 years. Nearshore wind is a compelling option for CPP compliance for a number of reasons:

1. Nearshore wind has the lowest levelized cost of electricity among all zero carbon-emitting technologies.
2. Nearshore wind can be a catalyst for offshore wind, which can provide higher capacity factors and improved coincidence between generation and peak load. By leveraging existing land-based infrastructure and permitting, offshore wind could reduce some of its grid interconnection costs.
3. Nearshore wind is much closer to load centers than the mountainous areas of the Southeast, lowering transmission upgrade costs.
4. Nearshore wind may be able to bypass the environmental and political barriers to development that mountainous locations have experienced (e.g., North Carolina's Ridge Law)

Altogether, nearshore wind in the U.S. Southeast offers a technically and economically compelling option for complying with the CPP. It is a technology that should be closely considered as part of a utility's future generation portfolio.

About FTI Consulting



GLOBAL REACH

With over 4,400 employees and offices in 26 countries on six continents, our breadth and depth extends across every major social, political, and economic hub across the globe



EXPERIENCED PROFESSIONALS

We are trusted advisors with diverse expertise and exceptional credentials serving clients globally



DEEP INDUSTRY EXPERTISE

We combine unparalleled expertise and industry knowledge to address critical challenges for clients. Our largest industry groups are:

- Construction
- **Energy, Power & Products**
- Financial Institutions & Insurance
- Healthcare & Life Sciences
- Real Estate
- Retail & Consumer Products
- Telecom, Media & Technology

FCN Publicly traded	\$1.58 BLN Market capitalization
1982 Year founded	80 Different disciplines
4,400+ Employees worldwide	700+ Industry specialists
440+ Senior Managing Directors	79 Offices in 79 cities around the globe
2 Nobel Laureates	47/100 47 of all Global 100 corporations are clients
10/10 Advisor to the world's top 10 bank holding companies	94/100 Advisor to 94 of the world's top 100 law firms



About FTI's Energy, Power & Products Segment

- FTI's Energy, Power, & Products segment is comprised of more than **300 professionals** focused on the unique challenges impacting the complex energy sector. The group includes many of the energy industry's **most respected names in consulting, energy economics, restructuring, and corporate finance.**
- In today's increasingly challenging energy industry, companies must contend with significant oil and gas market volatility with prices falling from historic highs to recent market lows, escalating development costs, declining traditional growth prospects, global climate change and national security concerns.
- At the same time, the industry continues to cope with conflicting regulatory frameworks, power industry restructuring, pervasive contractual disputes and costly litigation. To assist our clients in these demanding times, **FTI professionals provide a wide array of economic and business consulting services that address the strategic, financial, regulatory and legal needs of the industry.**
- Our intimate knowledge of the energy industry allows us to ask the right questions, pursue the appropriate analyses and develop solid conclusions/recommendations that address the challenges and opportunities facing our clients. **We have helped clients operating in all aspects of the energy industry, including crude oil, natural gas, coal, refined products, chemicals, renewables, and biofuels.**



Ken Ditzel
+1 (703) 966-1954
ken.ditzel@fticonsulting.com

Aris Karcanias
+44 (0)20 3727 1282
aris.karcanias@fticonsulting.com

Rob Fisher
+1 (202) 589-3408
rob.fisher@fticonsulting.com

CRITICAL THINKING
AT THE CRITICAL TIME™

About FTI Consulting

FTI Consulting, Inc. is a global business advisory firm dedicated to helping organizations protect and enhance enterprise value in an increasingly complex legal, regulatory and economic environment. FTI Consulting professionals, who are located in all major business centers throughout the world, work closely with clients to anticipate, illuminate and overcome complex business challenges in areas such as investigations, litigation, mergers and acquisitions, regulatory issues, reputation management and restructuring.

www.fticonsulting.com

©2015 FTI Consulting, Inc. All rights reserved.