Emissions Averaging and Rate Based Trading Under the 111(d) GHG Rule

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Duke Energy At A Glance

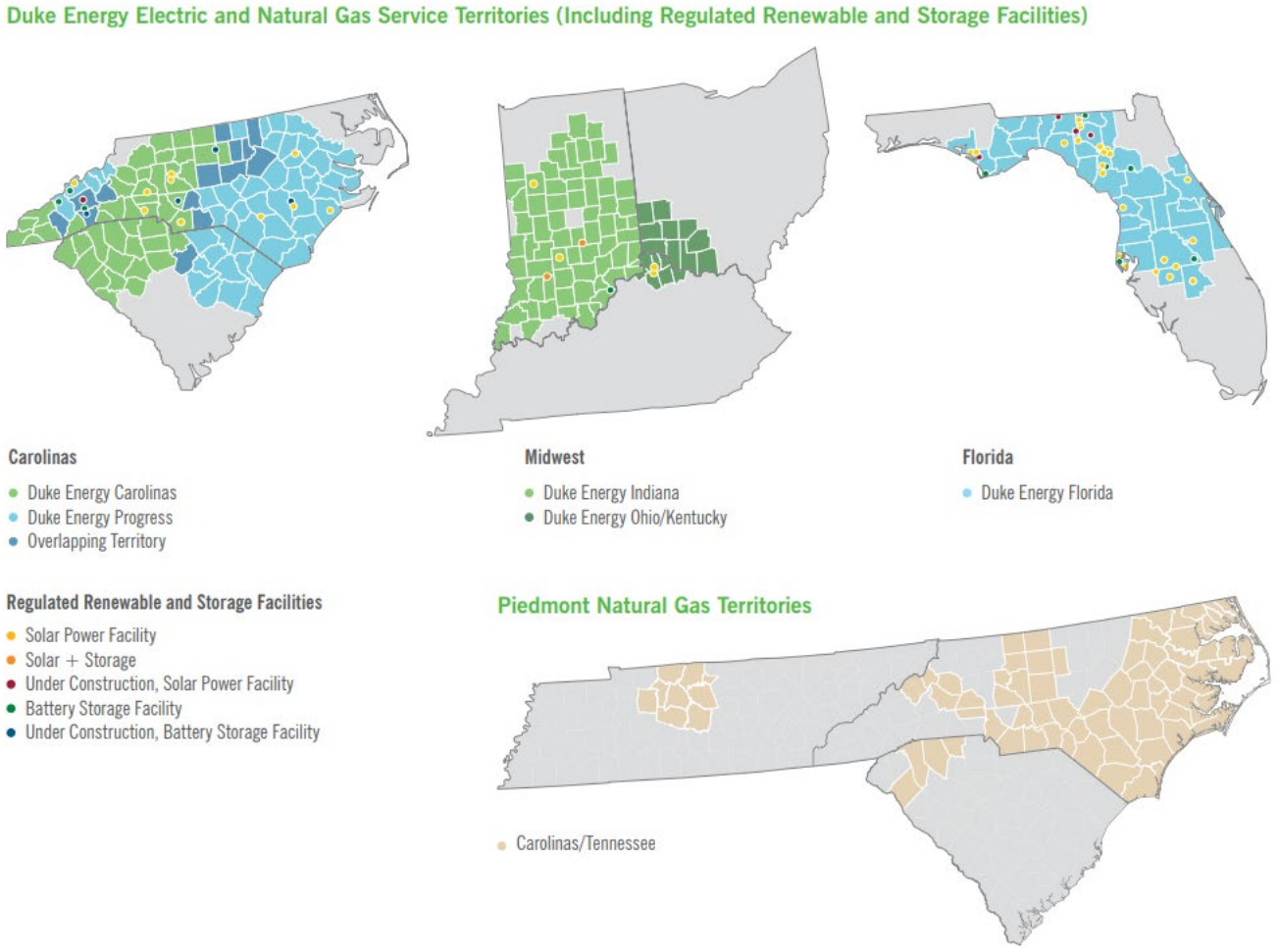
8.4 Million
retail electric customers in six states

1.7 Million
natural gas customers in five states

More than
27,000
employees

Approximately
55 GW
of generating capacity

$170 -$180 Billion
capital plan



Compliance Flexibilities Under the 111(d) Rule

- EPA identified emissions averaging and rate-based trading as compliance flexibilities that states can adopt in their plans
  - *States may incorporate emission trading and averaging into their plans … provided that the use of such flexibilities will result in an aggregate level of emission reduction that is equivalent to each source individually achieving its standard of performance.*
- These are alternative methods for demonstrating compliance for existing units
- They will improve compliance, cost effectiveness, and increase flexibility
- Demonstrating that these alternatives are equivalent to BSER is mathematically straight forward
- Even greater benefits could be achieved when these tools used on an interstate basis than just within a single state and/or company

111(d) Process for Setting Emission Rate Limits

- Define a baseline (8 quarter-period from 5-yr. period prior to FR publish date)
- Medium-term coal units: 40% co-fire requirement results in 16% reduction
- Long-term coal units: 90% CO_2 capture results in 88.4% reduction
- Example:
  - Co-firing: 2,000 lb CO_2/MWh × 84% = 1,680 lb CO_2/MWh
  - CCS: 2,000 lb CO_2/MWh × 11.6% = 232 lb CO_2/MWh

Emissions Averaging Process

- Use the Title IV NOx averaging program as a template (25+ years experience)
- Multiple units are averaged together to demonstrate compliance in aggregate
  - Compliance is demonstrated annually on a rate basis (lb CO_2/MWh)
  - Average unit emission rates are weighted by generation
  - Emissions limits for the same units are also weighted by generation
  - The weighted average of the actual rates must be less than that of the limits
- Unlike Title IV, the 111(d) rule envisions that averaging plans are constructed for a single company and within a single state

Showing Compliance with Emissions Averaging

	CO_2 Mass (tons)	Generation (MWhr)	Actual CO_2 Rate (lb/MWhr)	CO_2 Limit, lb/MWhr)	% Co-firing
Unit 1	3,200,000	4,000,000	1600	1680	50%
Unit 2	738,000	900,000	1640	1680	45%
Unit 3	750,000	750,000	2000	1680	0%
Totals	4,688,000	5,650,000	1659	1680	

$$\frac{\sum_{i=1}^{n} (R_i \times MW_i)}{\sum_{i=1}^{n} MW_i} \leq \frac{\sum_{i=1}^{n} (L_i \times MW_i)}{\sum_{i=1}^{n} MW_i}$$

Where:

- R_i = Actual annual average emission rate for unit i, lb/MWhr;
- L_i = State plan's annual emission rate limit for unit i, lb/MWhr;
- MW_i = Actual annual gross generation for unit i, MWhrs;
- n = Number of units in the plan.

Basis of a Rate Based Trading Program

- CO_2 Emission Reduction Credits (CRCs) are awarded to a unit when it operates below its state plan emission rate limit on an annual basis
  - The number of tons a unit operated below its limit can be quantified and converted into CRCs
  - CRCs become a tradable commodity that can transferred to another unit to offset a portion of its emissions
  - CRCs are not the same as allowances in a conventional “cap and trade program”
  - There is no specific limit to the number of CRCs that can be generated

Demonstrating Compliance Using CRCs

Earning CRCs

$$CE = \frac{(L - A) \times MW}{2000}$$

Using CRCs for Compliance

$$L \geq \frac{(E - CU) \times 2000}{MW}$$

Where:

- L = Annual emission rate limit for the unit, lb/MWhr;
- A = State plan's actual annual average emission rate for the unit, lb/MWhr;
- MW = Actual annual gross generation for the unit, MWhrs;
- CE= Number of CRCs (tons) earned by a unit in a year*;
- E = Actual annual CO_2 emissions from a unit (tons);
- CU = Number of CRCs (tons) used by a unit to demonstrate compliance that year.

A unit's emission rate, adjusted for CRCs consumed, must be less than its annual emission rate limit

* Note: CRC awards are truncated to whole tons.

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Advantages of Rate Based Trading

- Sources receiving CRCs based on how well they perform below their established limit allows them to plan with better certainty
- CRCs can be banked for later use or traded to units in other states and/or owned by other companies
- There is no creation of a state “ allowance budget” or allocation process which simplifies the state plan requirements
- A CRC based on one ton CO_2 removed becomes a common currency among different sources and states and facilitates an interstate program
- Existing combustion turbines could eventually be incorporated in the program if included in a future rulemaking

Other Elements of a Trading Program

- Units would use averaging or trading to demonstrate compliance, but not both
- The program would use same emissions data currently reported to EPA
- For units that receive compliance extensions (e.g., RULOF), then that unit could only enter a trading program once that extension expires
- For units that receive alternative limits (e.g., RULOF), then unit may need to be excluded from participating in a trading program
- In the event an exceptional (reliability) event occurs, then the generation & and emissions during that event would be excluded from calculations

Creating an Interstate Trading Program

- Developing a trading program that integrates the actions of many individual states would deliver more benefits
- It is more efficient to develop one common program instead of each state developing its own system independently
- EPA's Clean Air & Power Division (CAPD) has extensive experience with administering trading programs, and it could support a 111(d) program
  - CAPD currently receives the emissions and other necessary information
  - It can establish accounts and has capability to calculate and award CRCs
  - With a common CRC commodity, the trading platform is well suited
  - Sources would use same designated representative as Acid Rain and other Federal trading programs

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