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Grid Electricity (DEF) Carbon Intensity Estimates

From L. Whitted, Duke Energy Florida, email communication to S. Roe, CCS, 3/11/2015.

Per our 2014 TYSP Filing, DEF's current Resource Mix including purchased power is:
Coal 25% at 10,100 Btu/kWh Avg HR
Natural Gas 72% at 7,000 Btu/kWh Avg HR
Renewables 3%

However, after CRS shuts-down (assume mid-2018) DEF's Resource Mix including purchased power will be:
Coal 14% at 10,000 Btu/kWh Avg HR
Natural Gas 81% at 6,500 Btu/kWh Avg HR
Renewables 5%

As for **delivery voltage adjustment factors**, calculated as the reciprocal of the appropriate delivery efficiency factors are as follows:
(Maybe we just provide USFSP delivery voltage interconnection level)

Delivery Voltage	Adjustment Factor
Transmission Voltage Delivery	1.0149
Primary Voltage Delivery	1.0249
Secondary Voltage Delivery	1.0639

Emissions factors: The Climate Registry, General Reporting Protocol, Default Emission Factors http://www.theclimateregistr

kg/MMBtu	CO2	N2O	CH4
Coal	94.38	0.0014	0.0007
Natural Gas	53.02	0.0028	0.0009
Renewables	0	0.0059	0.0093

AR5 GWF	CO2	N2O	CH4
	1	265	28
	1	265	28
	1	265	28

tCO2e/TJ	CO2	N2O	CH4
Coal	99.57	0.39	0.02
Natural Gas	55.94	0.78	0.03
Renewables	0.00	1.65	0.27

L. Whitted at DEF states: renewable mix for 2014 is 58% MSW and 42% woody biomass. Some small amounts from Phosphate CHP and solar. Current analysis assumes 100% MSW/woody biomass.

Duke Energy Florida Carbon Intensity

Resource (% Net Gen.)	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048	2049	2050
Coal	25%	25%	25%	25%	25%	25%	25%	25%	25%	14%	14%	14%	14%	14%	14%	14%	14%	14%	14%	14%	14%	14%	14%	14%	14%	14%	14%	14%	14%	14%	14%	14%	14%	14%	14%	14%	14%	14%	14%	14%	14%
Natural Gas	72%	72%	72%	72%	72%	72%	72%	72%	72%	84%	84%	84%	84%	84%	84%	84%	84%	84%	84%	84%	84%	84%	84%	84%	84%	84%	84%	84%	84%	84%	84%	84%	84%	84%	84%	84%	84%	84%	84%	84%	84%
Renewables	3%	3%	3%	3%	3%	3%	3%	3%	3%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%
Heat Rate (Btu/kWh)																																									
Coal	10,100	10,100	10,100	10,100	10,100	10,100	10,100	10,100	10,100	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000
Natural Gas	7,000	7,000	7,000	7,000	7,000	7,000	7,000	7,000	7,000	6,500	6,500	6,500	6,500	6,500	6,500	6,500	6,500	6,500	6,500	6,500	6,500	6,500	6,500	6,500	6,500	6,500	6,500	6,500	6,500	6,500	6,500	6,500	6,500	6,500	6,500	6,500	6,500	6,500	6,500	6,500	6,500
Renewables [1]	10,100	10,100	10,100	10,100	10,100	10,100	10,100	10,100	10,100	10,100	10,100	10,100	10,100	10,100	10,100	10,100	10,100	10,100	10,100	10,100	10,100	10,100	10,100	10,100	10,100	10,100	10,100	10,100	10,100	10,100	10,100	10,100	10,100	10,100	10,100	10,100	10,100	10,100	10,100	10,100	10,100
Heat Rate (TJ/MWh)																																									
Coal	0.0107	0.0107	0.0107	0.0107	0.0107	0.0107	0.0107	0.0107	0.0107	0.0106	0.0106	0.0106	0.0106	0.0106	0.0106	0.0106	0.0106	0.0106	0.0106	0.0106	0.0106	0.0106	0.0106	0.0106	0.0106	0.0106	0.0106	0.0106	0.0106	0.0106	0.0106	0.0106	0.0106	0.0106	0.0106	0.0106	0.0106	0.0106	0.0106	0.0106	0.0106
Natural Gas	0.0074	0.0074	0.0074	0.0074	0.0074	0.0074	0.0074	0.0074	0.0074	0.0069	0.0069	0.0069	0.0069	0.0069	0.0069	0.0069	0.0069	0.0069	0.0069	0.0069	0.0069	0.0069	0.0069	0.0069	0.0069	0.0069	0.0069	0.0069	0.0069	0.0069	0.0069	0.0069	0.0069	0.0069	0.0069	0.0069	0.0069	0.0069	0.0069	0.0069	0.0069
Renewables	0.0107	0.0107	0.0107	0.0107	0.0107	0.0107	0.0107	0.0107	0.0107	0.0107	0.0107	0.0107	0.0107	0.0107	0.0107	0.0107	0.0107	0.0107	0.0107	0.0107	0.0107	0.0107	0.0107	0.0107	0.0107	0.0107	0.0107	0.0107	0.0107	0.0107	0.0107	0.0107	0.0107	0.0107	0.0107	0.0107	0.0107	0.0107	0.0107	0.0107	0.0107
Delivered Electricity Carbon Intensity																																									
CO2 Emission Factor (tCO2e/MWh)	0.563	0.563	0.563	0.563	0.563	0.563	0.563	0.563	0.563	0.469	0.469	0.469	0.469	0.469	0.469	0.469	0.469	0.469	0.469	0.469	0.469	0.469	0.469	0.469	0.469	0.469	0.469	0.469	0.469	0.469	0.469	0.469	0.469	0.469	0.469	0.469	0.469	0.469	0.469	0.469	0.469
N2O Emission Factor (tCO2e/MWh)	0.006	0.006	0.006	0.006	0.006	0.006	0.006	0.006	0.006	0.006	0.006	0.006	0.006	0.006	0.006	0.006	0.006	0.006	0.006	0.006	0.006	0.006	0.006	0.006	0.006	0.006	0.006	0.006	0.006	0.006	0.006	0.006	0.006	0.006	0.006	0.006	0.006	0.006	0.006	0.006	0.006
CH4 Emission Factor (tCO2e/MWh)	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003
Carbon Intensity of Generation (tCO2e/MWh)	**0.569**	**0.569**	**0.569**	**0.569**	**0.569**	**0.569**	**0.569**	**0.569**	**0.569**	**0.476**	**0.476**	**0.476**	**0.476**	**0.476**	**0.476**	**0.476**	**0.476**	**0.476**	**0.476**	**0.476**	**0.476**	**0.476**	**0.476**	**0.476**	**0.476**	**0.476**	**0.476**	**0.476**	**0.476**	**0.476**	**0.476**	**0.476**	**0.476**	**0.476**	**0.476**	**0.476**	**0.476**	**0.476**	**0.476**	**0.476**	**0.476**
T&D Loss Rate (%) [2]	7.88%	7.88%	7.88%	7.88%	7.88%	7.88%	7.88%	7.88%	7.88%	7.88%	7.88%	7.88%	7.88%	7.88%	7.88%	7.88%	7.88%	7.88%	7.88%	7.88%	7.88%	7.88%	7.88%	7.88%	7.88%	7.88%	7.88%	7.88%	7.88%	7.88%	7.88%	7.88%	7.88%	7.88%	7.88%	7.88%	7.88%	7.88%	7.88%	7.88%	7.88%
Delivered Carbon Intensity (tCO2e/MWh)	**0.613**	**0.613**	**0.613**	**0.613**	**0.613**	**0.613**	**0.613**	**0.613**	**0.613**	**0.513**	**0.513**	**0.513**	**0.513**	**0.513**	**0.513**	**0.513**	**0.513**	**0.513**	**0.513**	**0.513**	**0.513**	**0.513**	**0.513**	**0.513**	**0.513**	**0.513**	**0.513**	**0.513**	**0.513**	**0.513**	**0.513**	**0.513**	**0.513**	**0.513**	**0.513**	**0.513**	**0.513**	**0.513**	**0.513**	**0.513**	**0.513**