Futures Development for the Long Term Study

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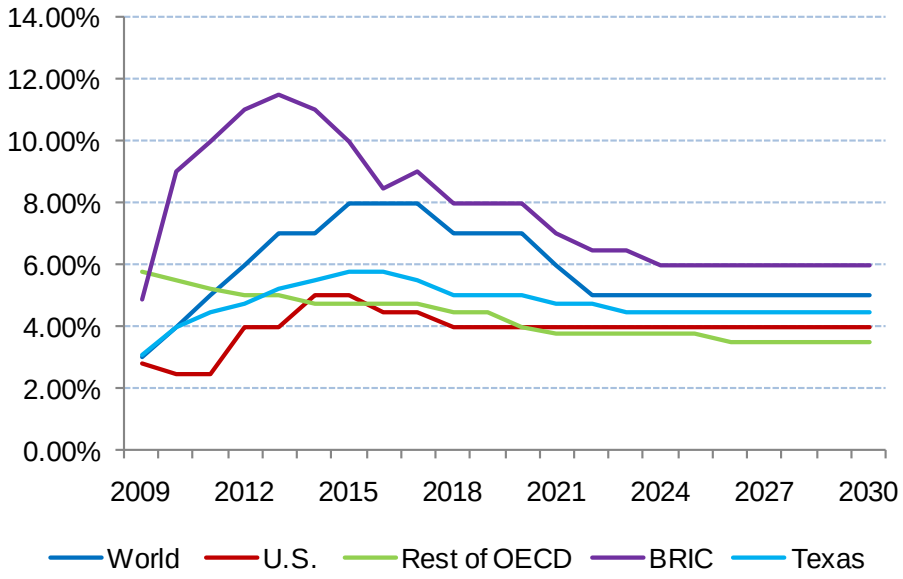
“Green Power” Scenario

- **US / World Impact**
  - Concerns about the environment are beginning to take center stage
  - "Kyoto 2" has been signed by all countries
  - Strong CO_2 (GHG) legislation and EE / renewable requirements have been set at high levels worldwide
  - General pace of economic growth is strong

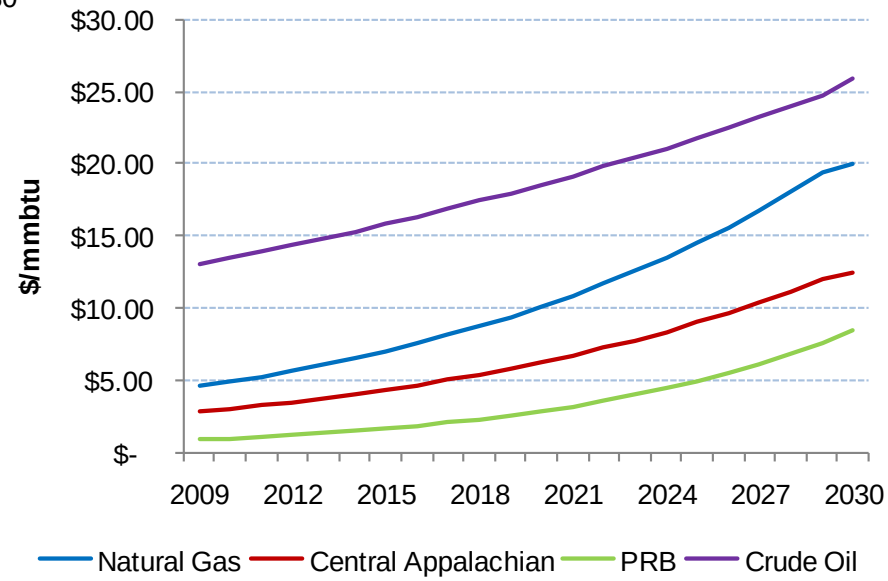
- **Texas Impact**
  - Texas continues to lead wind development
  - Renewable build out rate increases
  - Demand response and energy efficiency programs see significant growth
  - Increase in combined cycle and combustion turbine activity as production from coal plants decreases and reliability issues mount

Scenario GDP and Fuel Prices

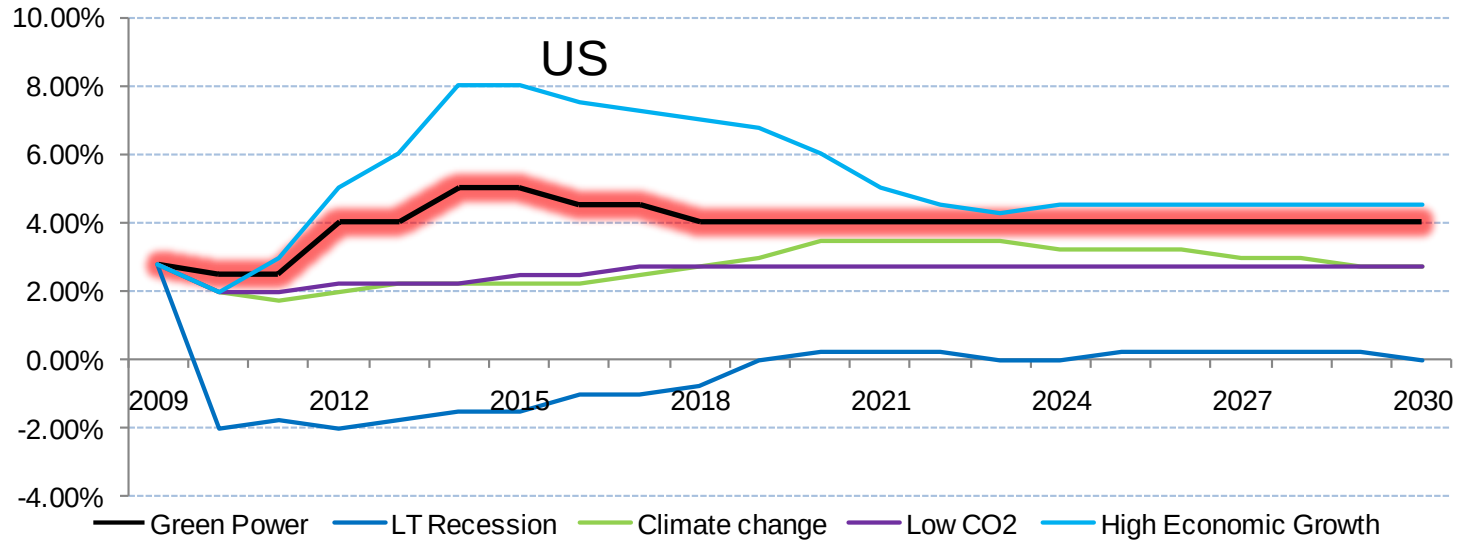


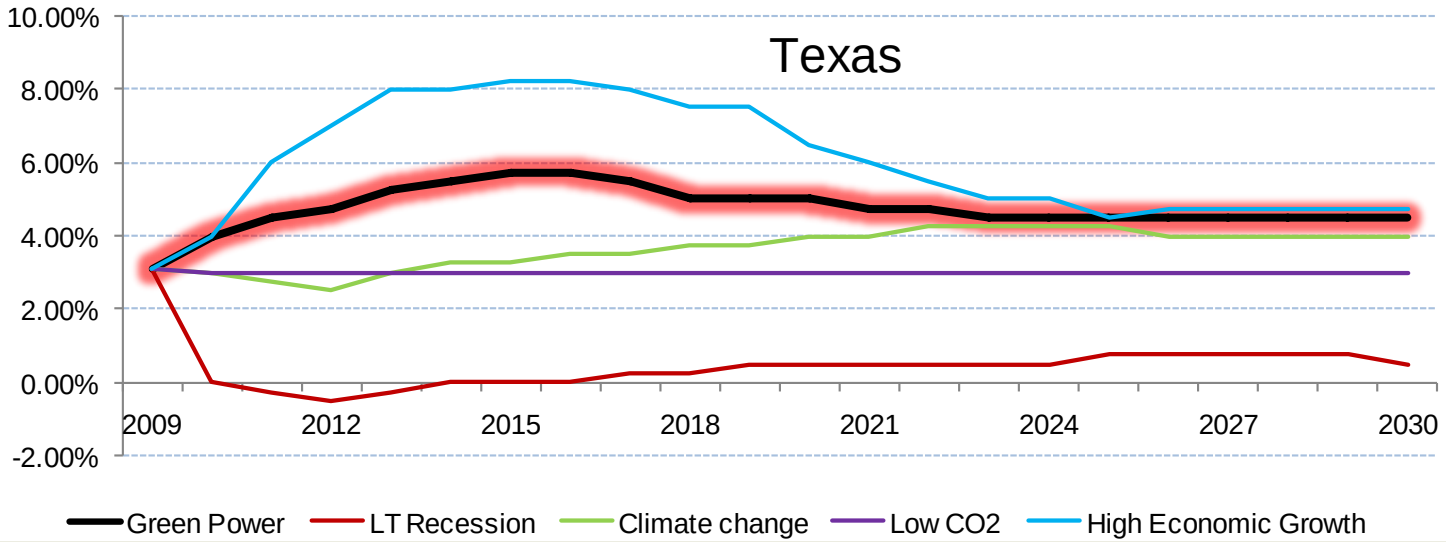
GDP rates are high in the first few years returning to rates in the 4% to 6% range in the later years

Fuel prices continue to climb as economies in China and India remain strong

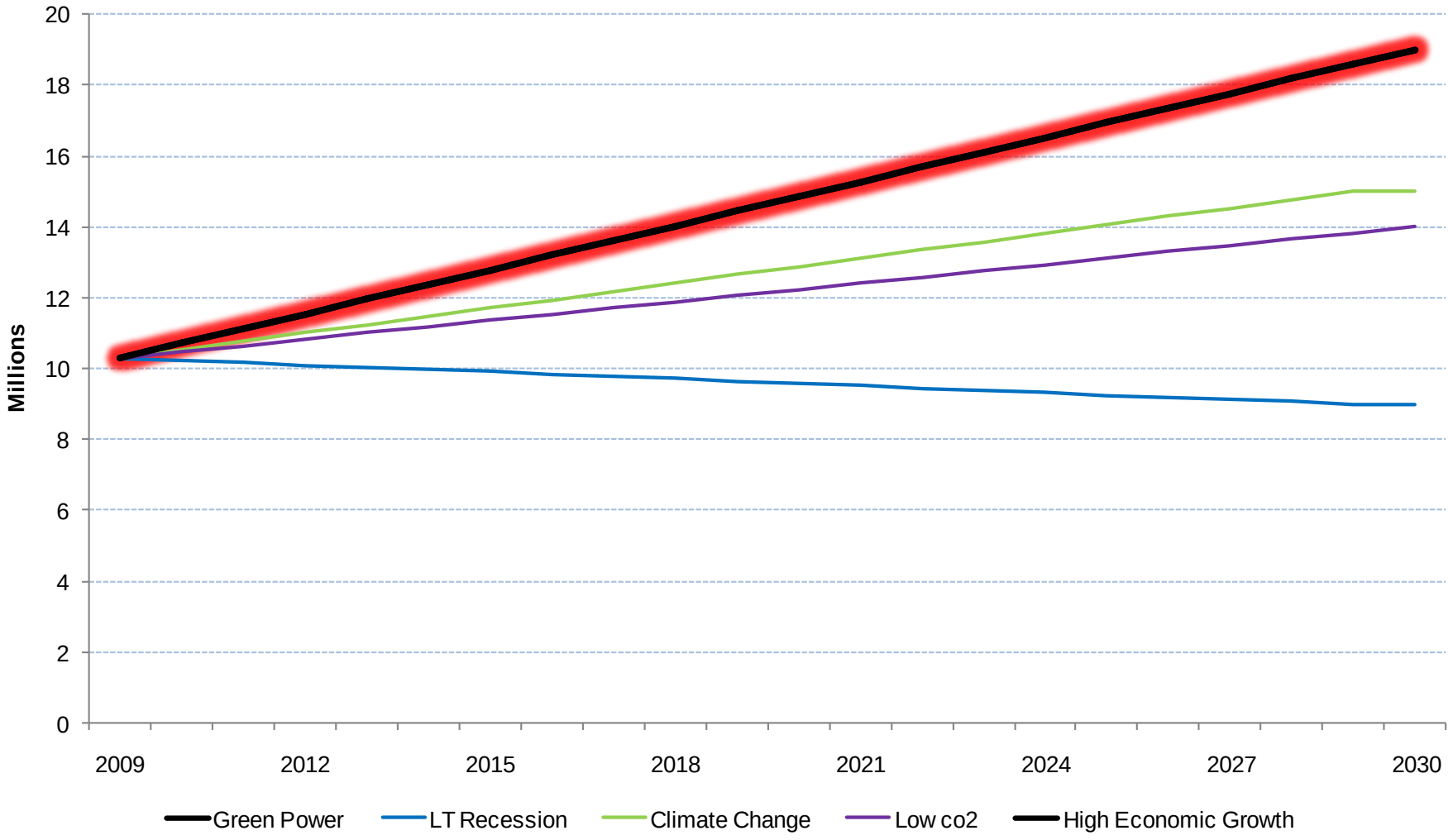


GDP Comparison





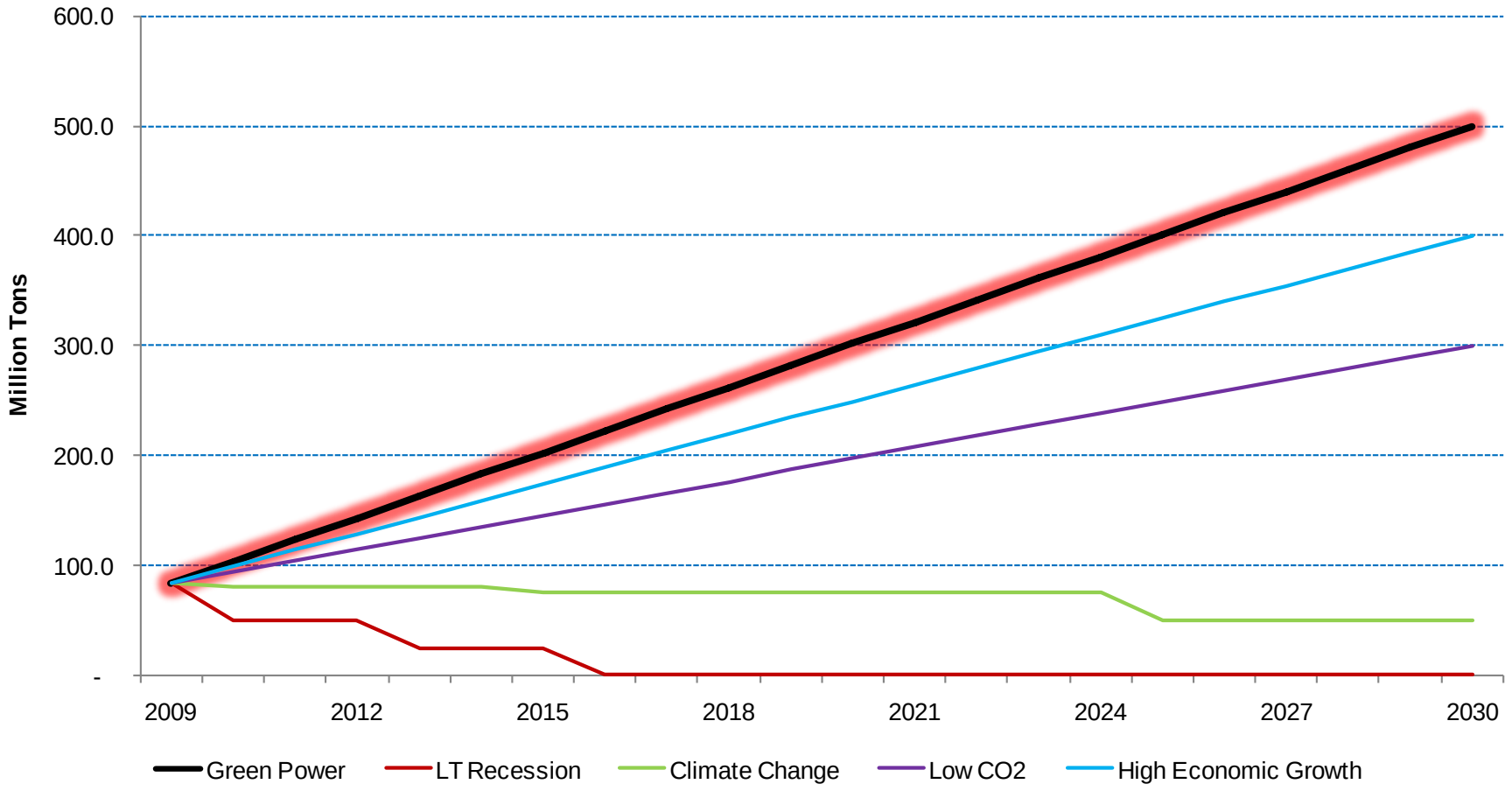
Texas Employment



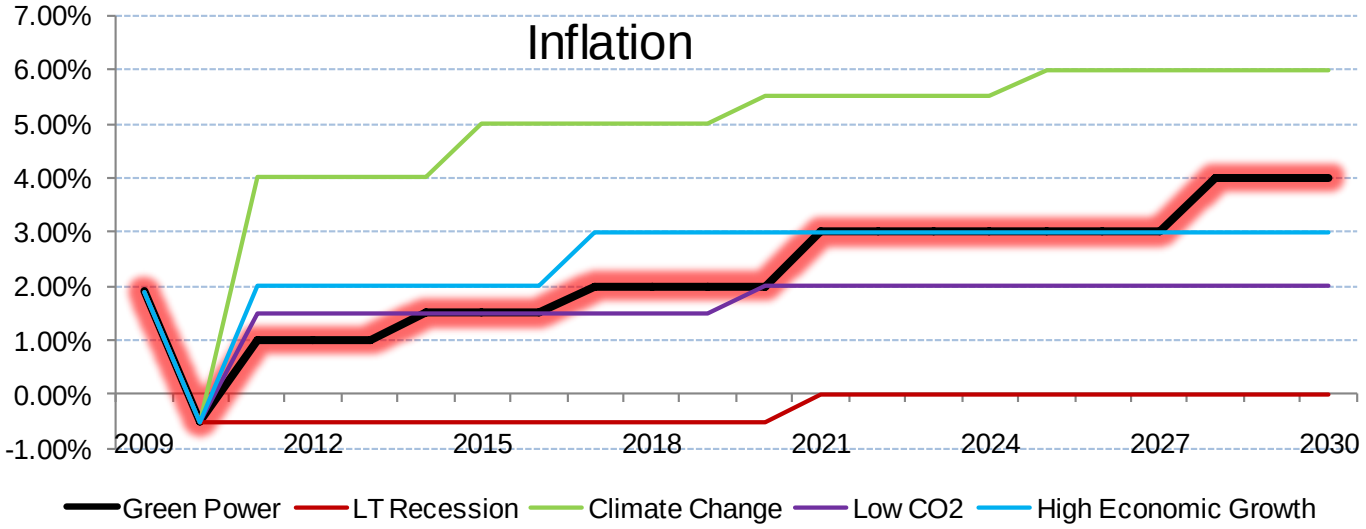
Green Power and high growth have the same employment values

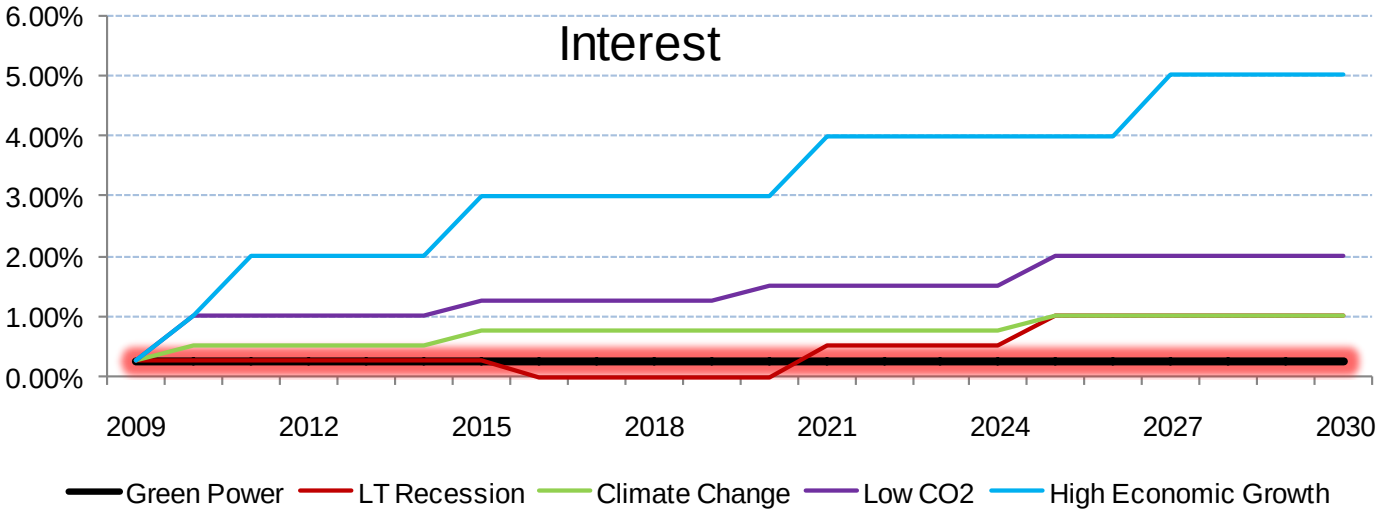
Coal Exports

Strong growth in the BRIC countries result in high coal export levels



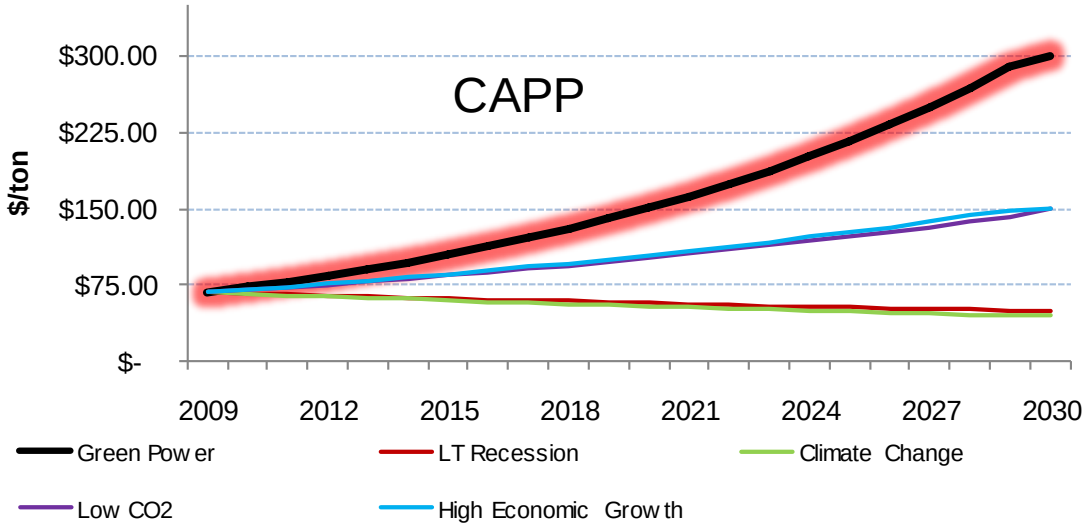
Inflation and Interest Rates

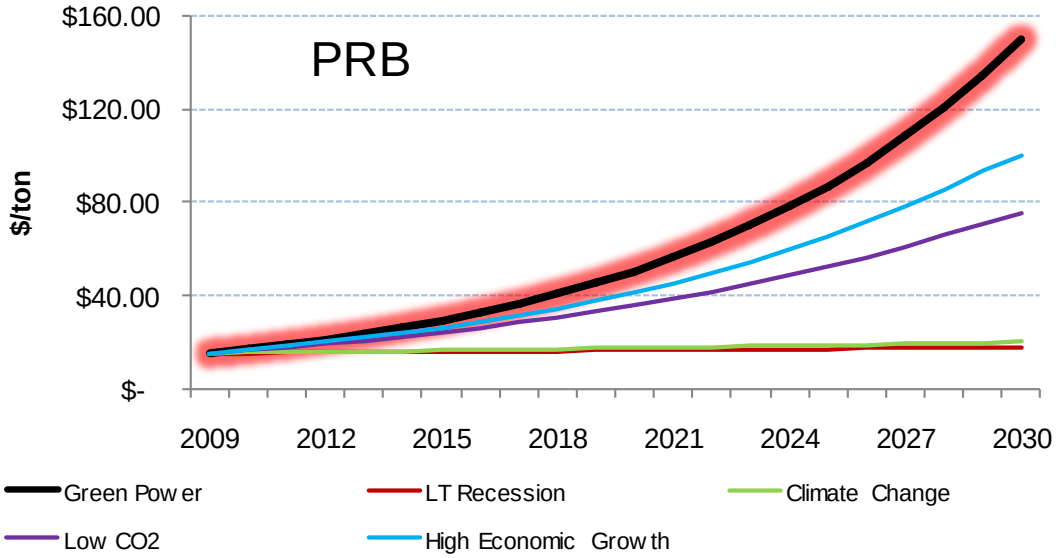




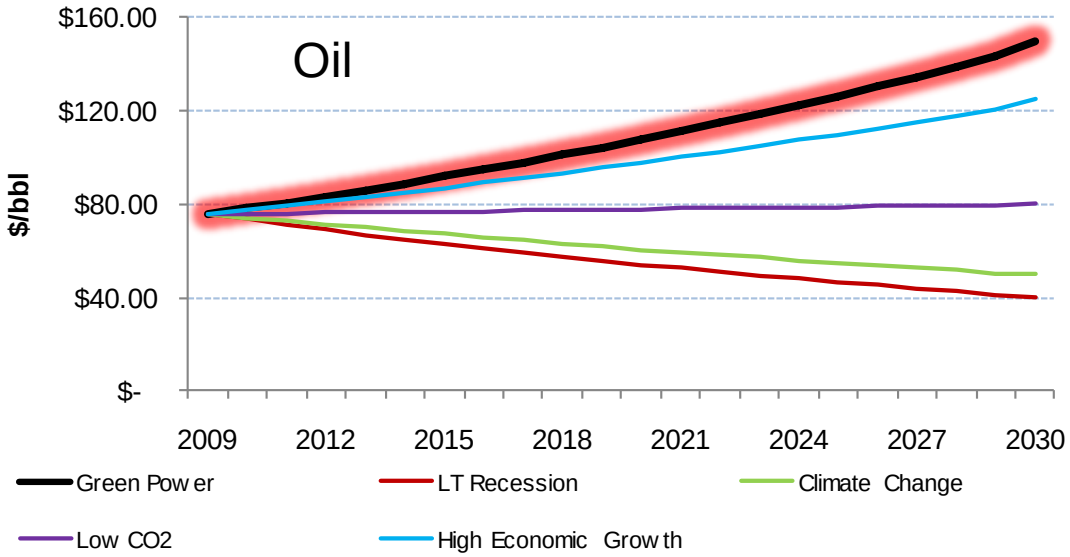
Fuel Price Comparison

Exports of coal to Asia keep prices rising

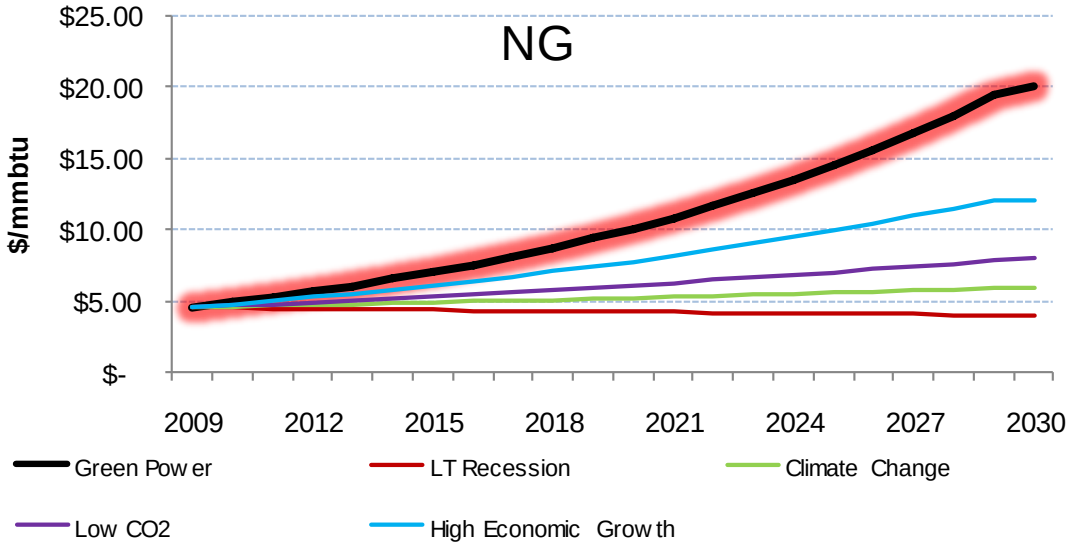




Fuel Price Comparison



As coal production decreases natural gas prices rise replacing the coal-fired generation



Planning Assumptions

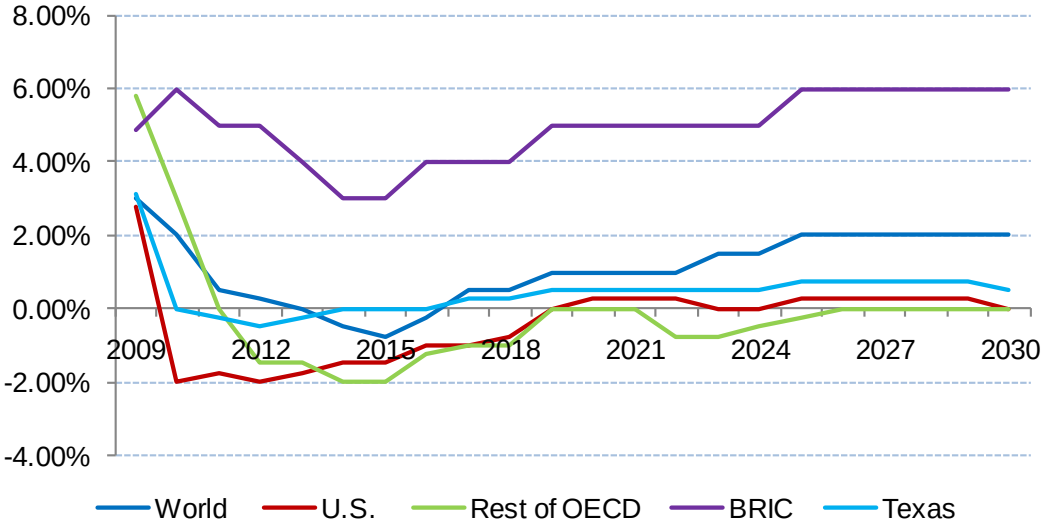
GDP	2010	2015	2020	2025	2030
World	4%	8%	7%	5%	5%
U.S.	3%	5%	4%	4%	4%
Rest of OECD	6%	5%	4%	4%	4%
BRIC	9%	10%	8%	6%	6%
Texas	4.0%	6%	5%	5%	5%
Macroeconomics					
U.S. Interest Rate (LIBOR)	0.50%	2%	5%	7%	8%
U.S. Inflation Rate	-0.5%	1.50%	2%	3%	4%
U.S. Tax Rate	35%	35%	35%	35%	35%
Non-Farm Employment Texas (millions)	10.71	12.79	14.86	16.93	19
Commodities (2010$)					
Crude Oil ($/bbl)	$ 78.16	$ 91.71	$ 107.62	$ 126.28	$ 150
Natural Gas ($/mmbtu)	$ 4.90	$ 7.04	$ 10.10	$ 14.50	$ 20
Central Appalachian ($/ton)	$ 72.94	$ 104.71	$ 150.33	$ 215.82	$ 300
Central Appalachian Heat Content (btu/lb)	12,000	12,000	12,000	12,000	12,000
Central Appalachian ($/mmbtu)	$ 3.04	$ 4.36	$ 6.26	$ 8.99	$ 12.50
PRB ($/ton)	$ 17.00	$ 29.30	$ 50.50	$ 87.03	$ 150
PRB Heat Content	8,800	8,800	8,800	8,800	8,800
PRB ($/mmbtu)	$ 0.97	$ 1.66	$ 2.87	$ 4.94	$ 8.52
U.S. Coal Exports (millions of tons per year)	103.33	202.50	301.67	400.83	500
Annual Emissions Costs (2010$/ton)					
NOx	$ 515	$ 600	$ 750	$ 1,000	$ 1,000
SO2	$ 6.00	$ 50	$ 100	$ 250	$ 300
CO2	$ -	$ 50	$ 75	$ 100	$ 100
Capital Costs (2010$/kW)					
Nuclear	$ 6,000	$ 6,000	$ 6,000	$ 6,000	$ 6,000
Coal with CCS	$ 4,500	$ 4,750	$ 5,000	$ 5,000	$ 5,000
Supercritical Coal	$ 3,500	$ 3,500	$ 3,250	$ 3,000	$ 3,000
Natural Gas Combined Cycle	$ 1,000	$ 1,200	$ 1,200	$ 1,200	$ 1,200
Natural Gas Peaking Facility	$ 800	$ 1,000	$ 1,000	$ 1,000	$ 1,000
Wind Turbine	$ 2,225	$ 2,500	$ 2,500	$ 2,500	$ 2,500
Geothermal	$ 4,500	$ 4,250	$ 4,000	$ 3,750	$ 3,750
Solar Farms	$ 4,940	$ 3,822	$ 2,958	$ 2,289	$ 1,771

“Long Term Recession” Scenario

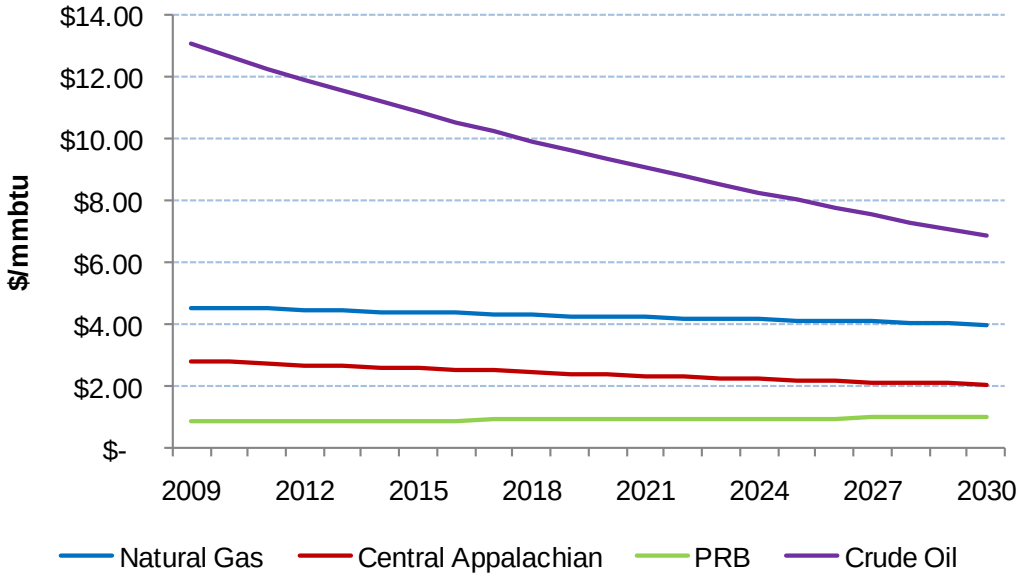
- **US / World Impact**
  - The world economy is in decline
  - Environmental regulations are eased as economic issues are paramount
  - Fuel prices are low as demand for energy declines
  - Inflation rates are low and interest rates are held at historically low levels to support fragile economies

- **Texas Impact**
  - Texas is the boom town in this future. Even so, there is no economic growth which results in no load growth
  - Actual load growth turns negative as industries continue to close
  - Public funded solar PV programs are in place for job creation
  - Generation build out is generally based on economics
    - Some wind and renewables but new technologies mature at a slower pace
    - Coal and NG resources are primary choice
    - Potential for substantial retirements for older units

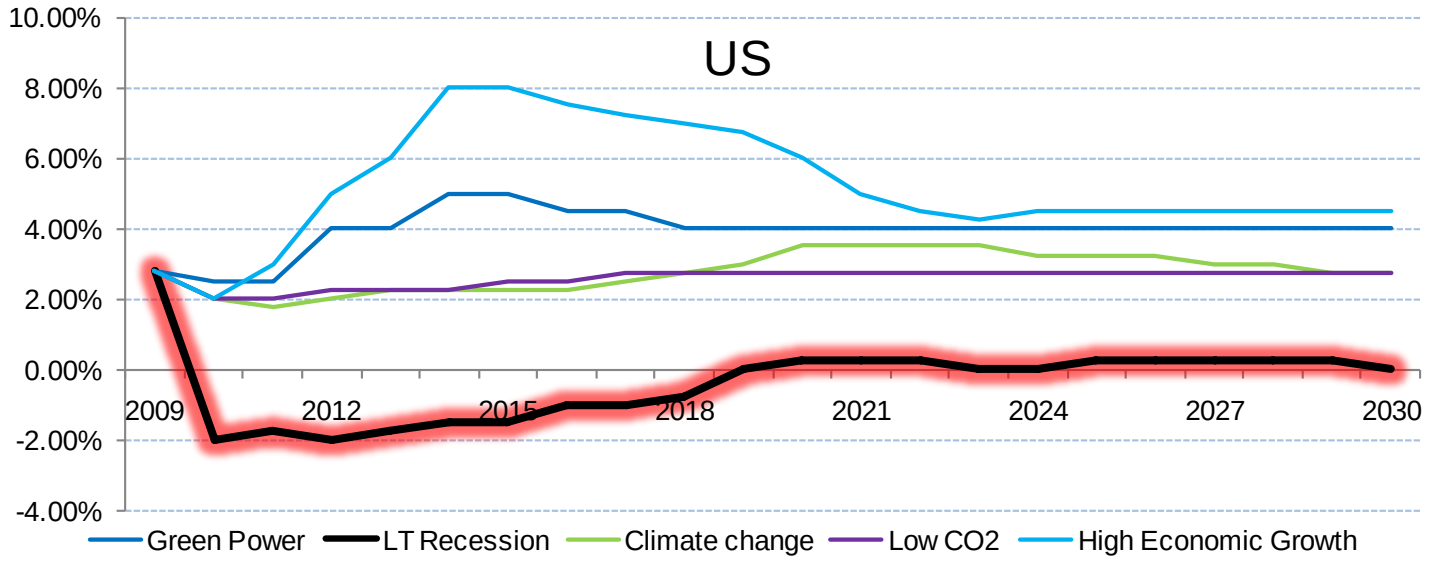
Scenario GDP and Fuel Prices

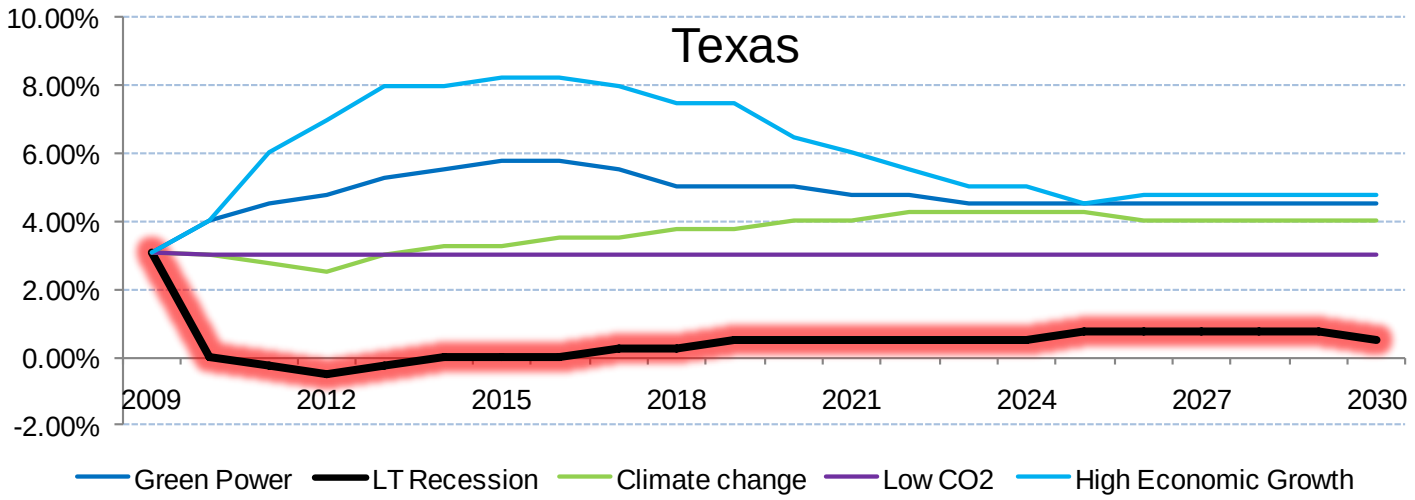


Fuel prices in a general decline as recession reduces energy consumption



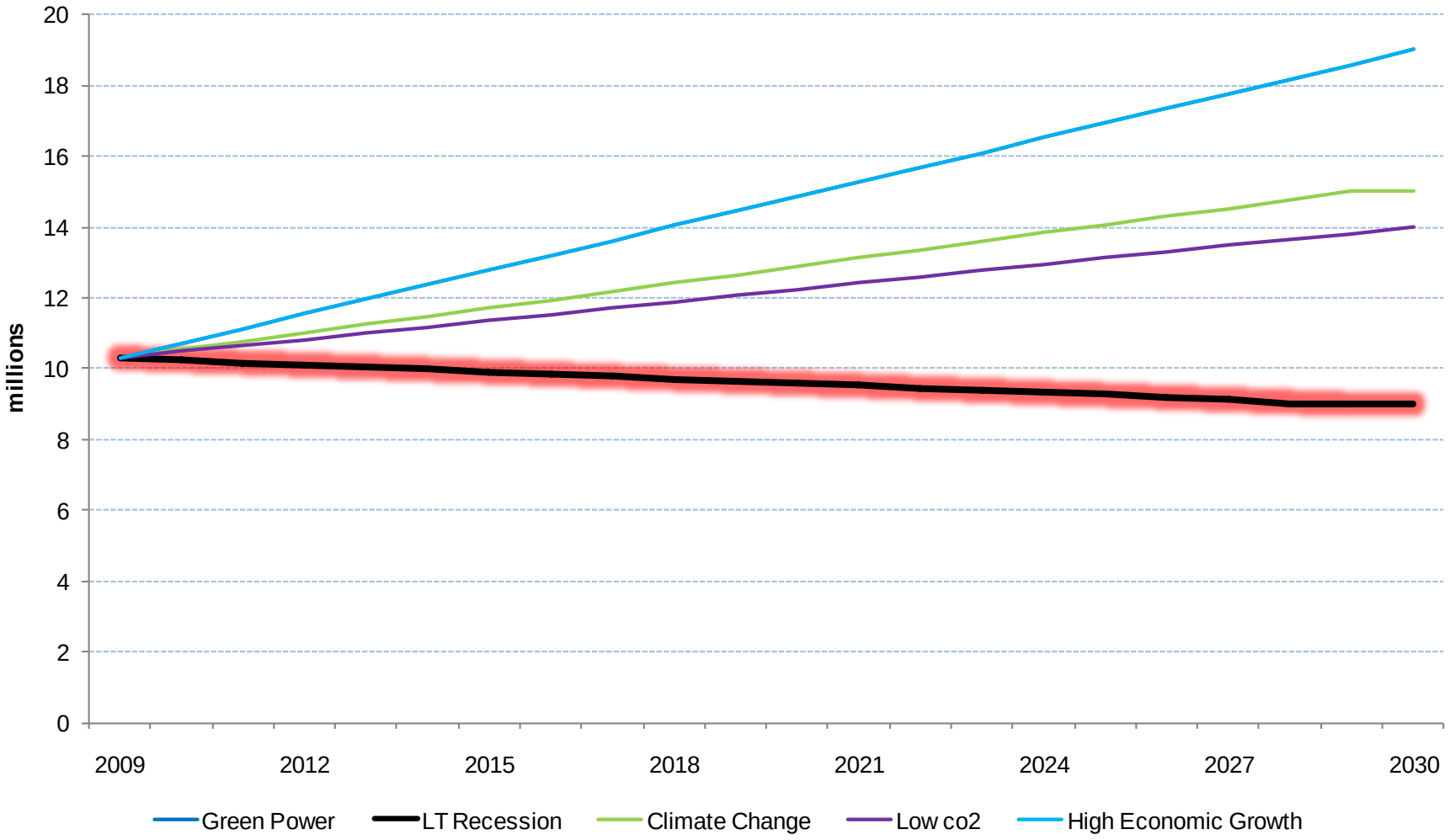
GDP Comparison





Texas Employment

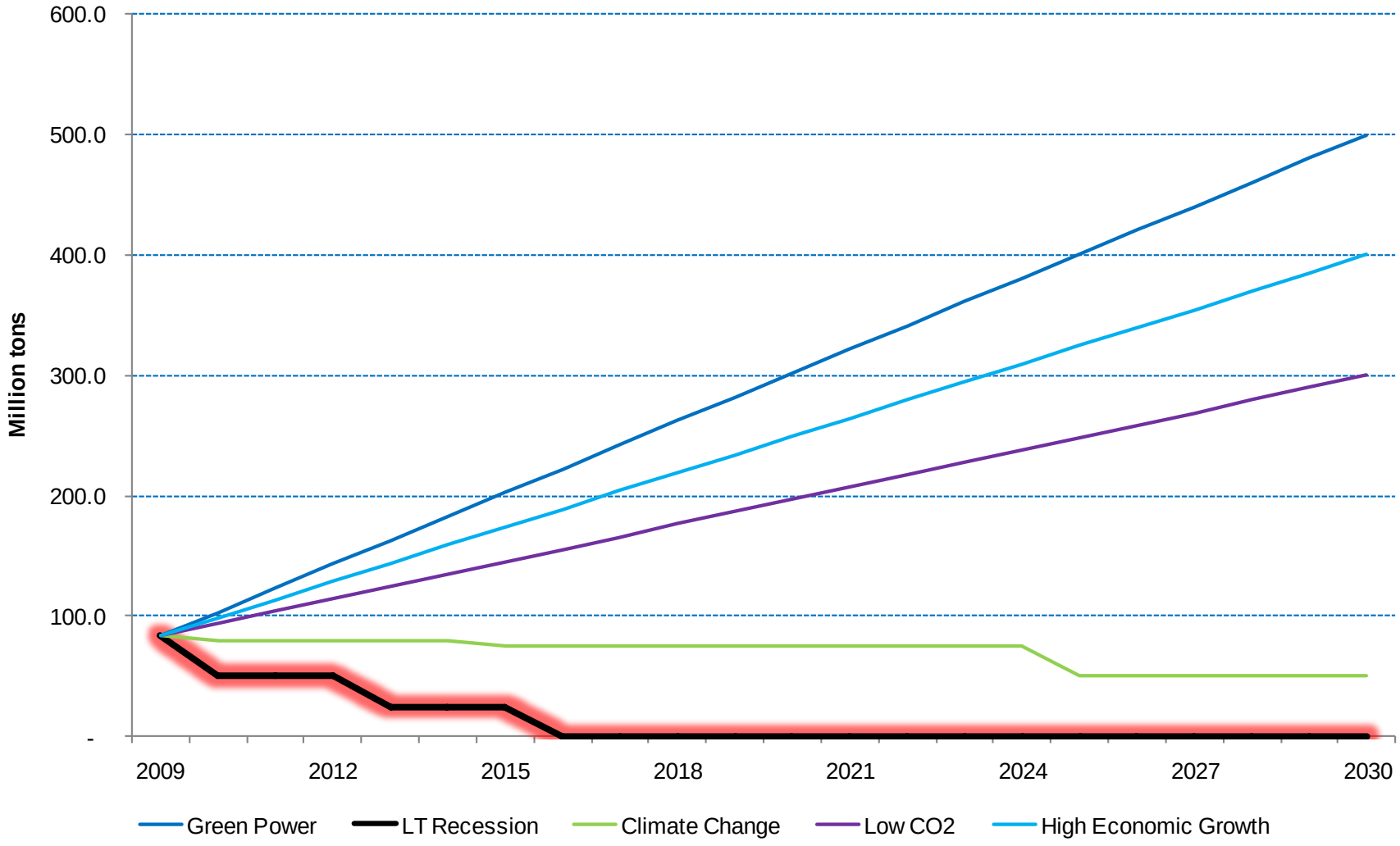
Long Term Recession



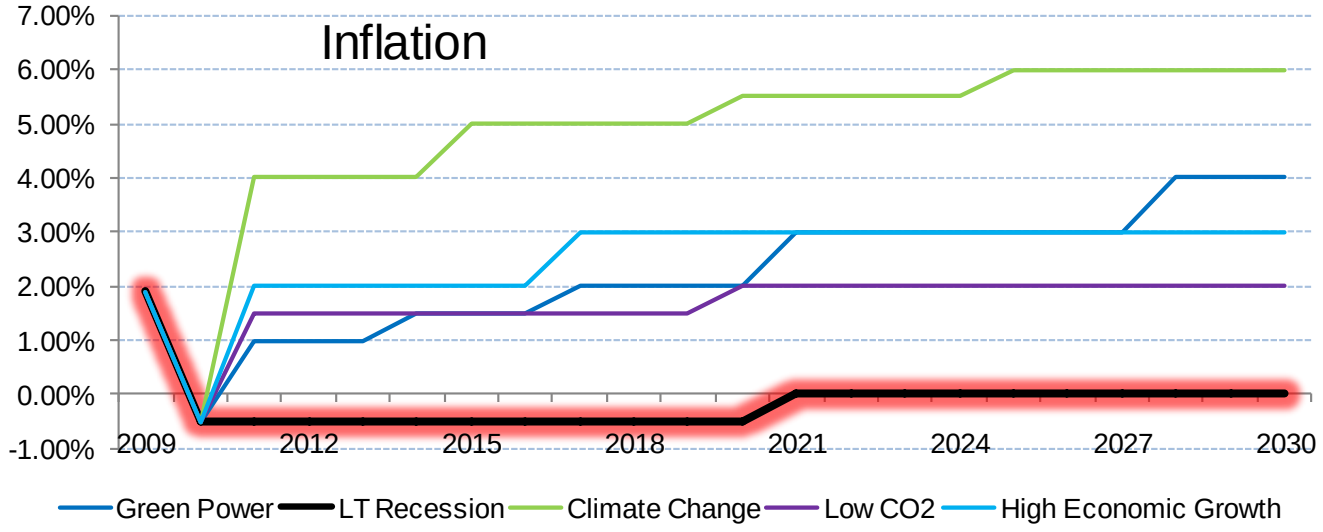
Green Power and High Economic Growth have the same employment values.

Coal Exports

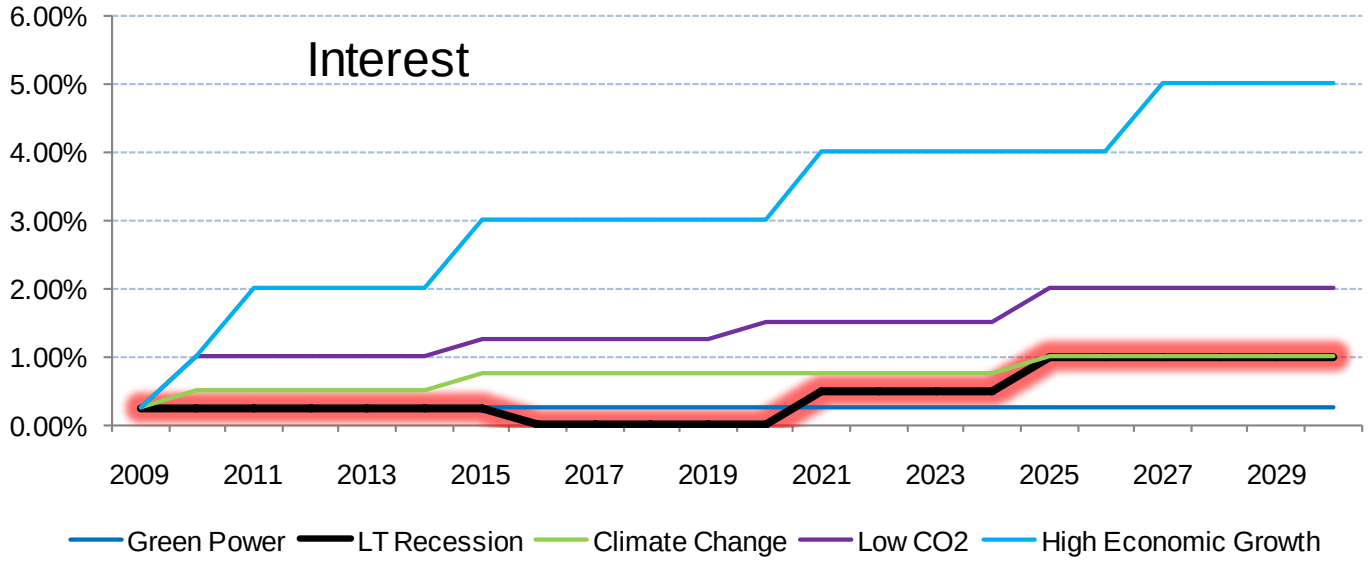
Long Term Recession



Inflation and Interest Rate Comparison



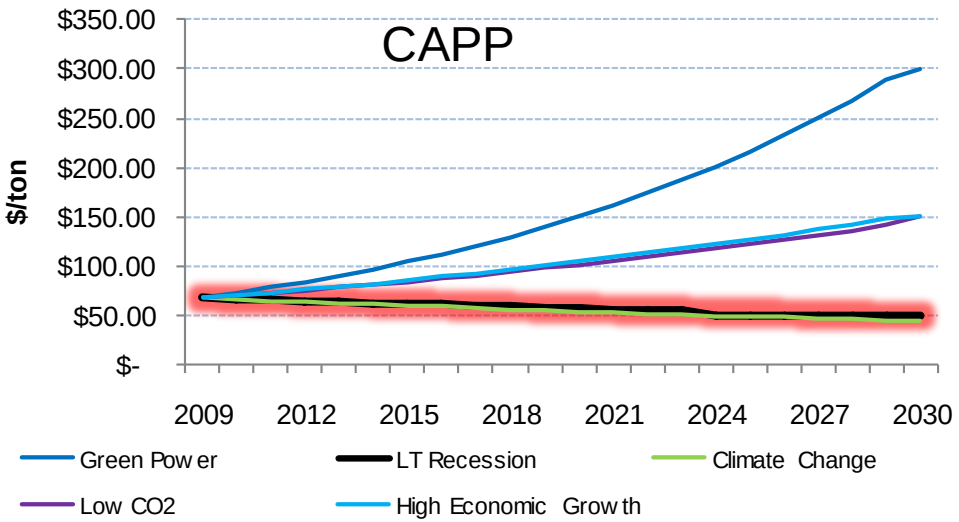
Inflation and interest rates will be held at record lows to help economy

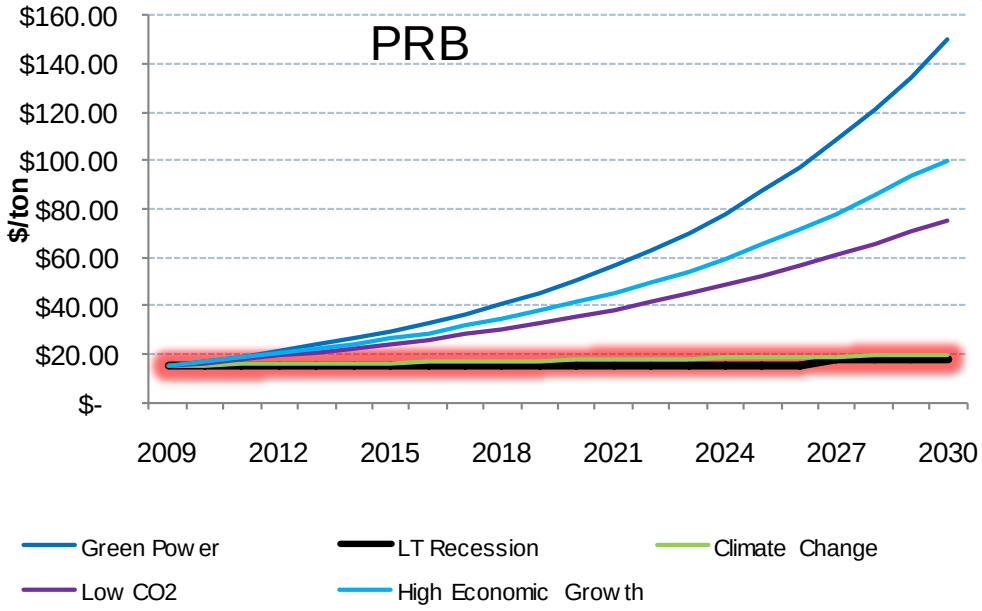


Fuel Price Comparison

Long Term Recession

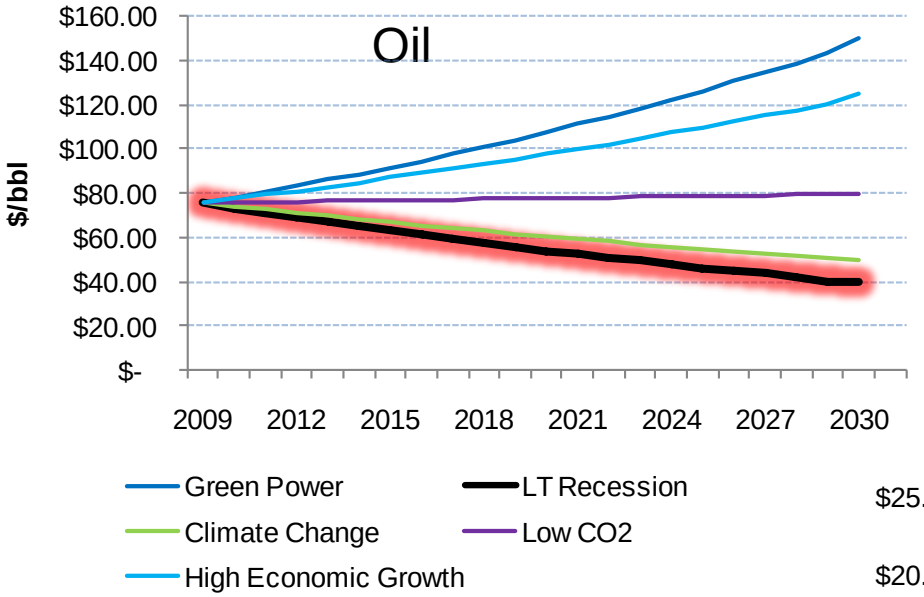
Coal prices remain flat as exports dry up

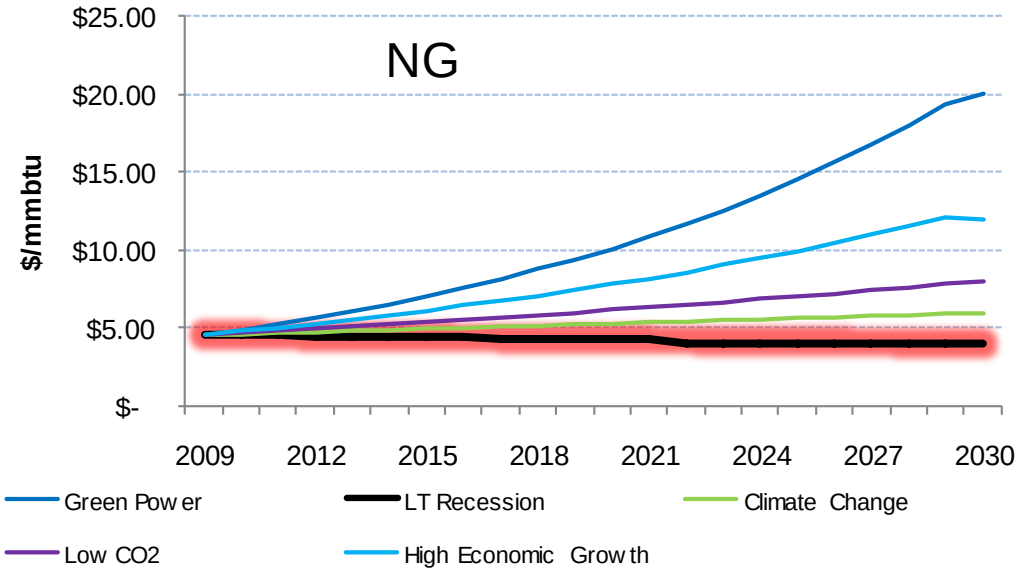




Fuel Price Comparison

Long Term Recession





Planning Assumptions

Long Term Recession

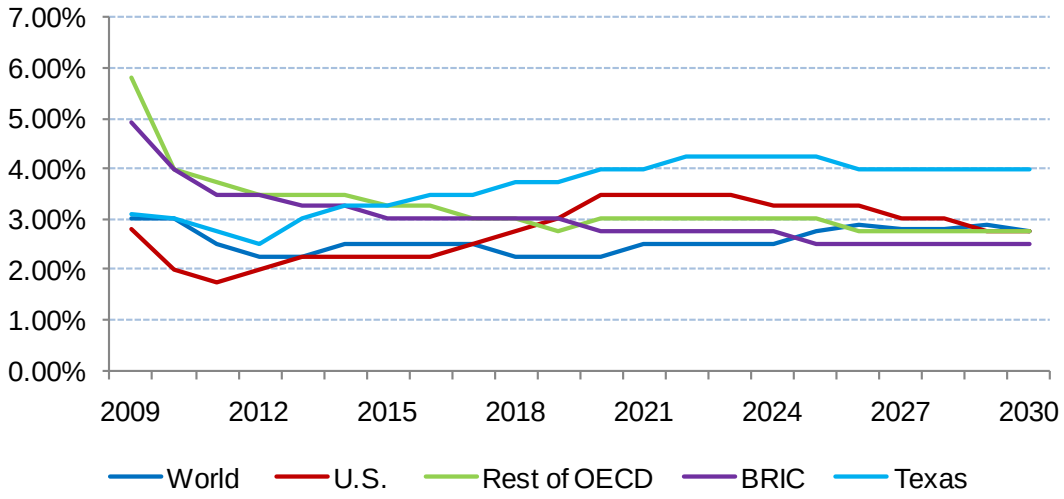
GDP	2010	2015	2020	2025	2030
World	2.00%	-0.8%	1.0%	2%	2%
U.S.	-2%	-2%	0%	0%	0%
Rest of OECD	3%	-2%	0%	0%	0%
BRIC	6%	3%	5%	6%	6%
Texas	0%	0%	0.50%	0.75%	0.5%
Macroeconomics					
U.S. Interest Rate (LIBOR)	0.25%	0.25%	0%	1%	1%
U.S. Inflation Rate	-0.50%	-0.50%	-0.50%	0%	0%
U.S. Tax Rate	38%	55%	60%	80%	80%
Non-Farm Employment Texas (millions)	10.24	9.91	9.59	9.26	9
Commodities (2010$)					
Crude Oil ($/bbl)	$ 73.43	$ 63.06	$ 54.15	$ 46.50	$ 40
Natural Gas ($/mmbtu)	$ 4.53	$ 4.40	$ 4.27	$ 4.14	$ 4
Central Appalachian ($/ton)	$ 66.83	$ 61.97	$ 57.46	$ 53.28	$ 50
Central Appalachian Heat Content (btu/lb)	12,000	12,000	12,000	12,000	12,000
Central Appalachian ($/mmbtu)	$ 2.78	$ 2.58	$ 2.39	$ 2.22	$ 2.08
PRB ($/ton)	$ 15.36	$ 15.95	$ 16.56	$ 17.19	$ 18
PRB Heat Content	8,800	8,800	8,800	8,800	8,800
PRB ($/mmbtu)	$ 0.87	$ 0.91	$ 0.94	$ 0.98	$ 1.02
U.S. Coal Exports (millions of tons per year)	50.00	25.00	0.00	0.00	0
Annual Emissions Costs ($/ton)					
NOx	$ 515	$ 450	$ 400	$ 350	$ 300
SO2	$ 6.00	$ 30	$ 50	$ 60	$ 60
CO2	$ -	$ -	$ -	$ -	$ -
Capital Costs ($/kW)					
Nuclear	$ 5,500	$ 5,250	$ 5,000	$ 5,000	$ 5,000
Coal with CCS	$ 4,500	$ 4,250	$ 4,000	$ 4,000	$ 4,000
Supercritical Coal	$ 3,500	$ 3,500	$ 3,450	$ 3,400	$ 3,400
Natural Gas Combined Cycle	$ 1,000	$ 1,000	$ 1,000	$ 1,000	$ 1,000
Natural Gas Peaking Facility	$ 800	$ 800	$ 800	$ 800	$ 800
Wind Turbine	$ 2,000	$ 1,750	$ 1,750	$ 1,500	$ 1,500
Geothermal	$ 4,500	$ 4,250	$ 4,000	$ 3,500	$ 3,000
Solar Farms	$ 5,000	$ 5,000	$ 4,750	$ 4,500	$ 4,500

“Climate Change” Scenario

- **US / World Impact**
  - Environmental concerns mount worldwide
  - World wide droughts grow or persist in generally dry regions and crops failing in some regions
  - Reduction of GHG emissions by any means possible is becoming the norm
    - Carbon prices climb causing fossil fuel use to decline and fuel prices to drop
    - Nuclear and solar is subsidized to encourage its development
    - Natural gas demand grows as a substitute for coal
  - Economic disparities become pronounced between countries based on reliance on fossil fuels

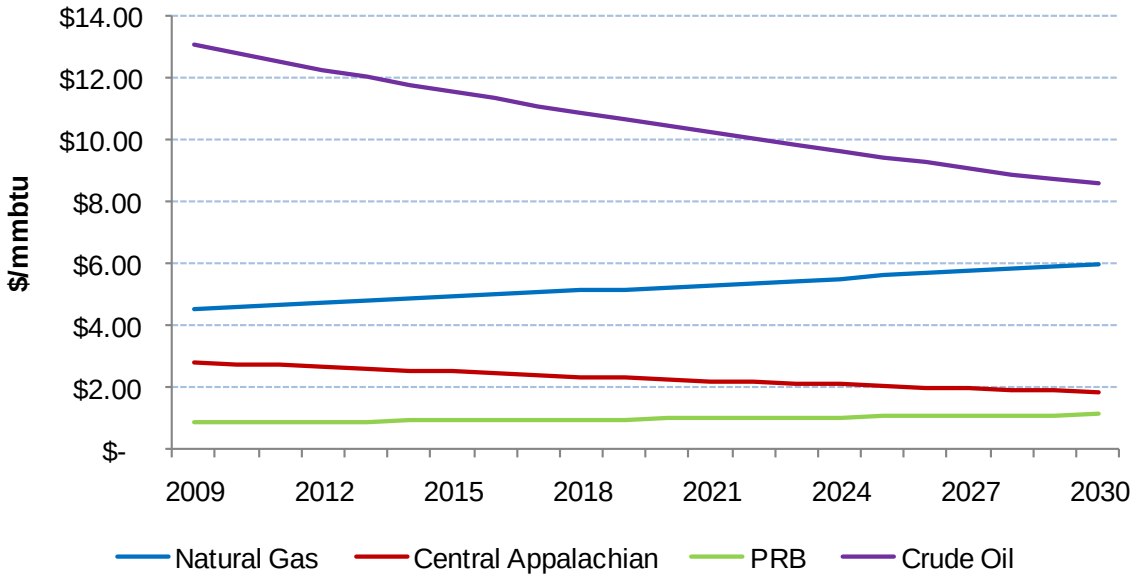
- **Texas Impact**
  - Availability of water begins to tighten
  - Water is at premium and some areas consider rationing
  - Desalination projects are being built
  - All low water usage technologies are being built
    - More wind and solar
    - Energy efficiency and demand response being implemented quickly
    - Dry cooled combined cycles and combustion turbines being built

Scenario GDP and Fuel Prices

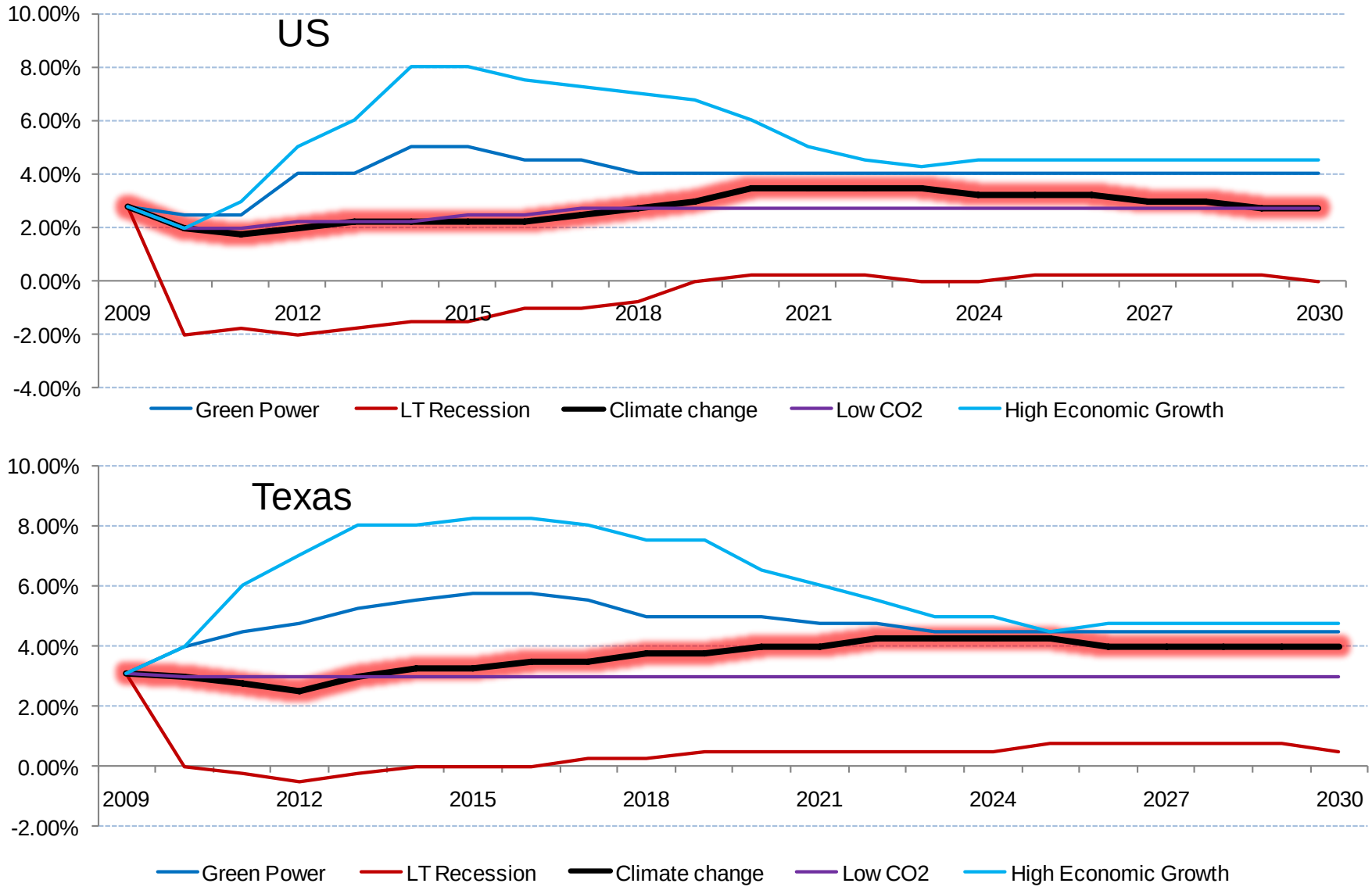


General economic growth will remain flat

Decline in fossil fuel prices with the exception of natural gas which is being used to replace coal

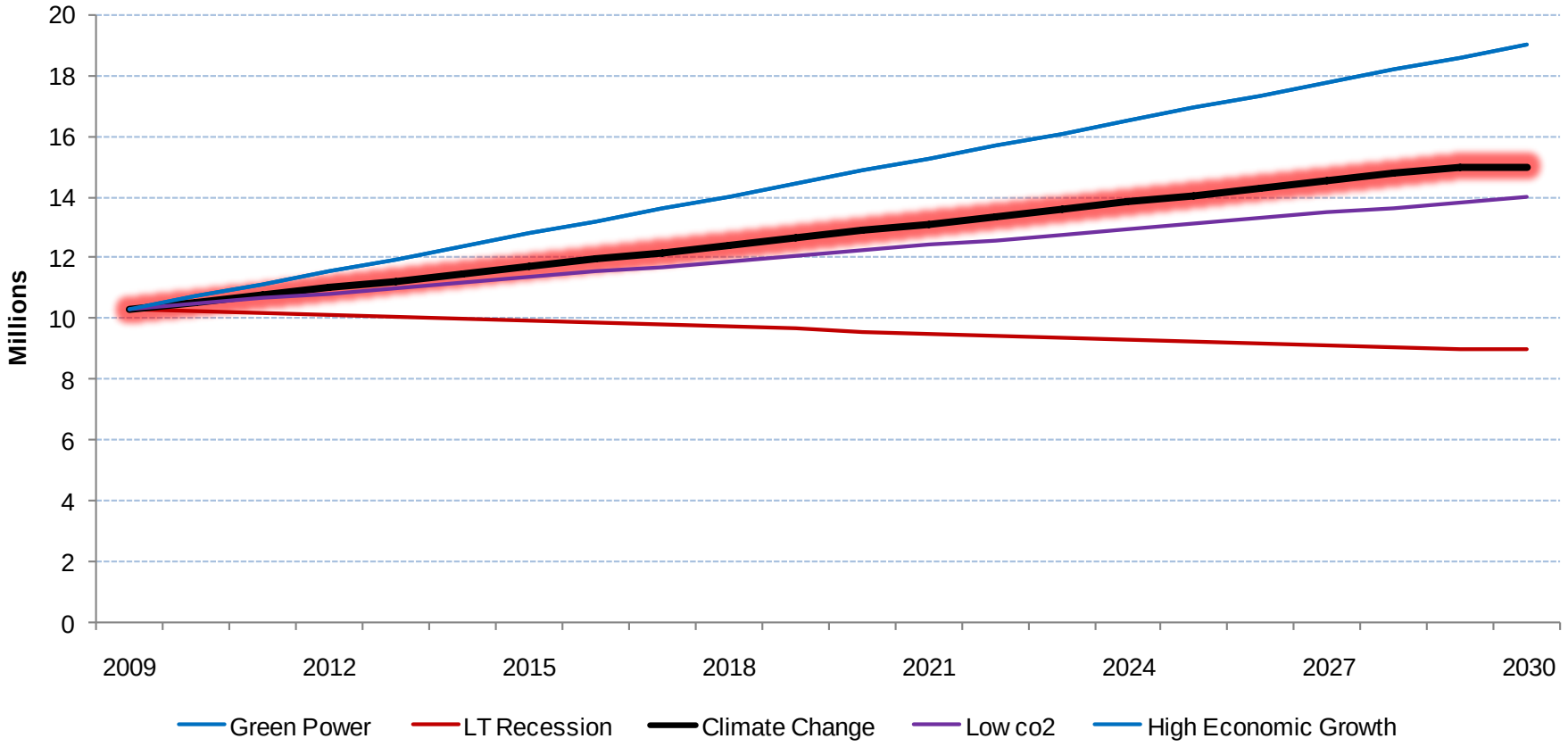


GDP Comparison



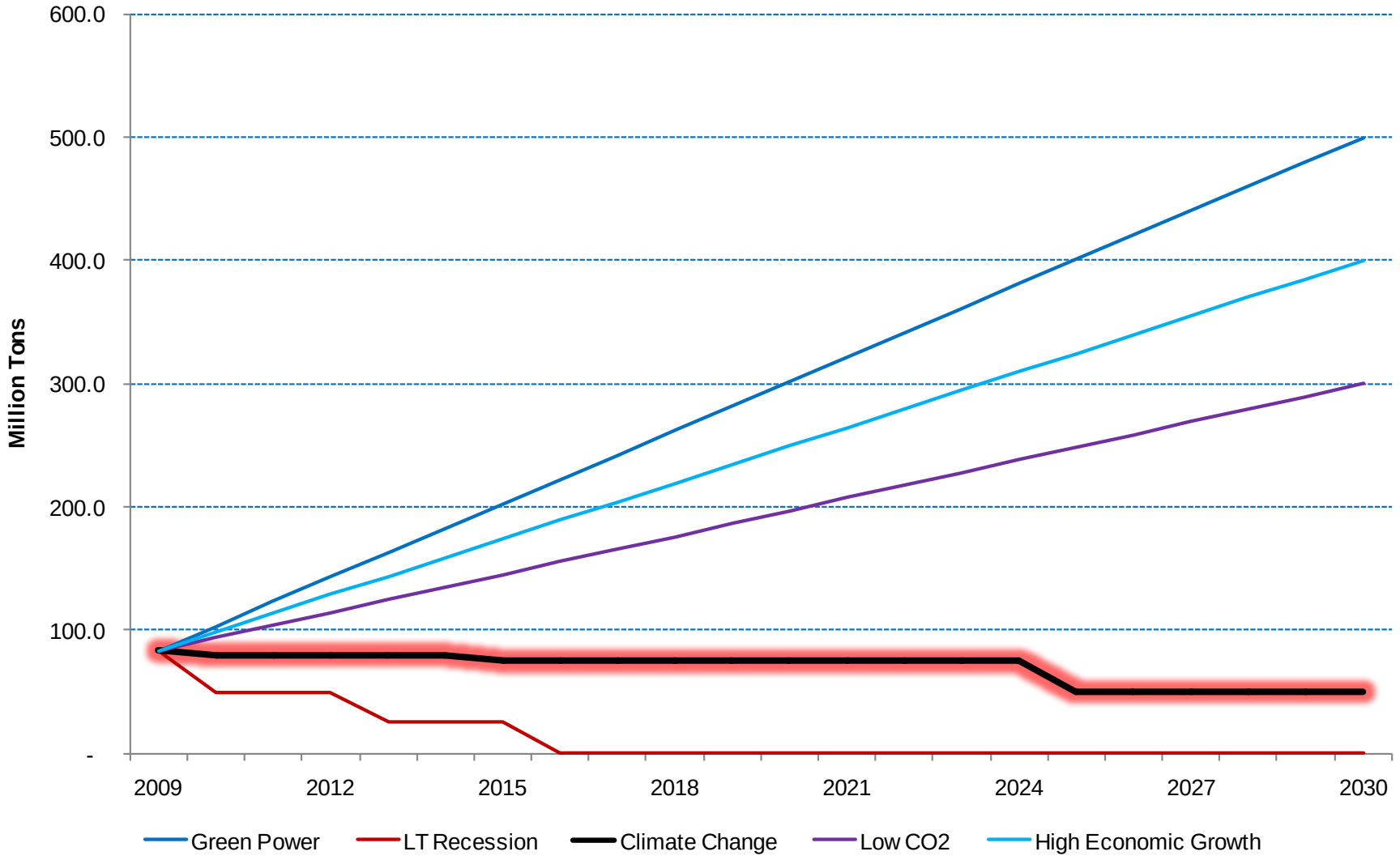
Texas Employment

Texas employment will continue to grow as energy from renewables keeps economy stable

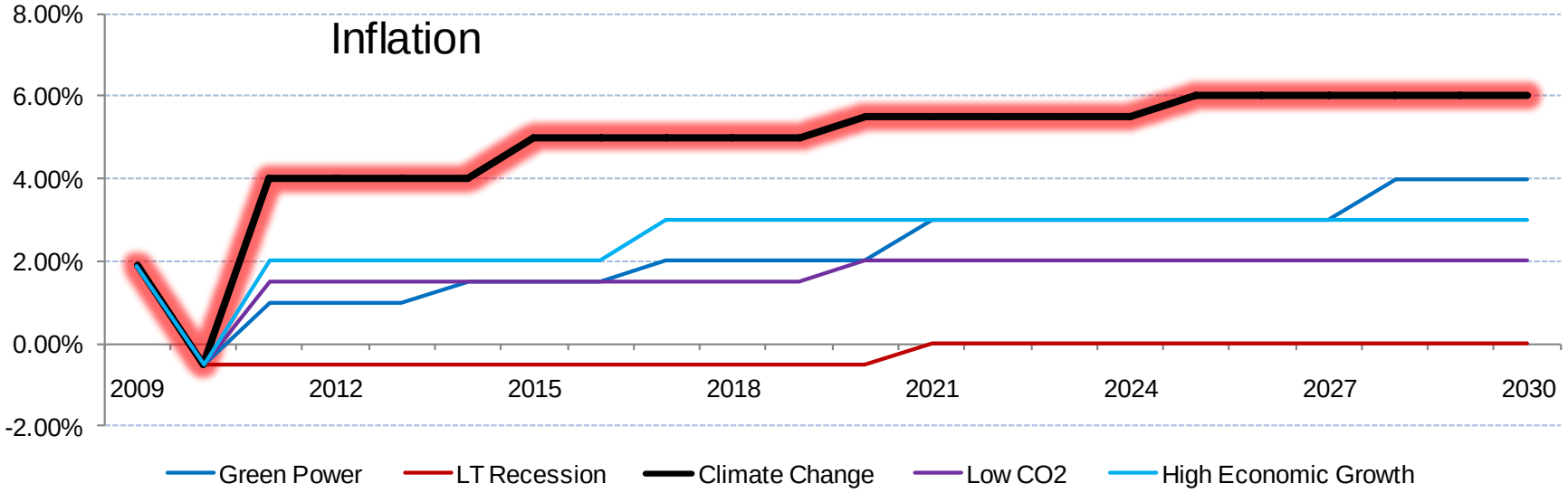


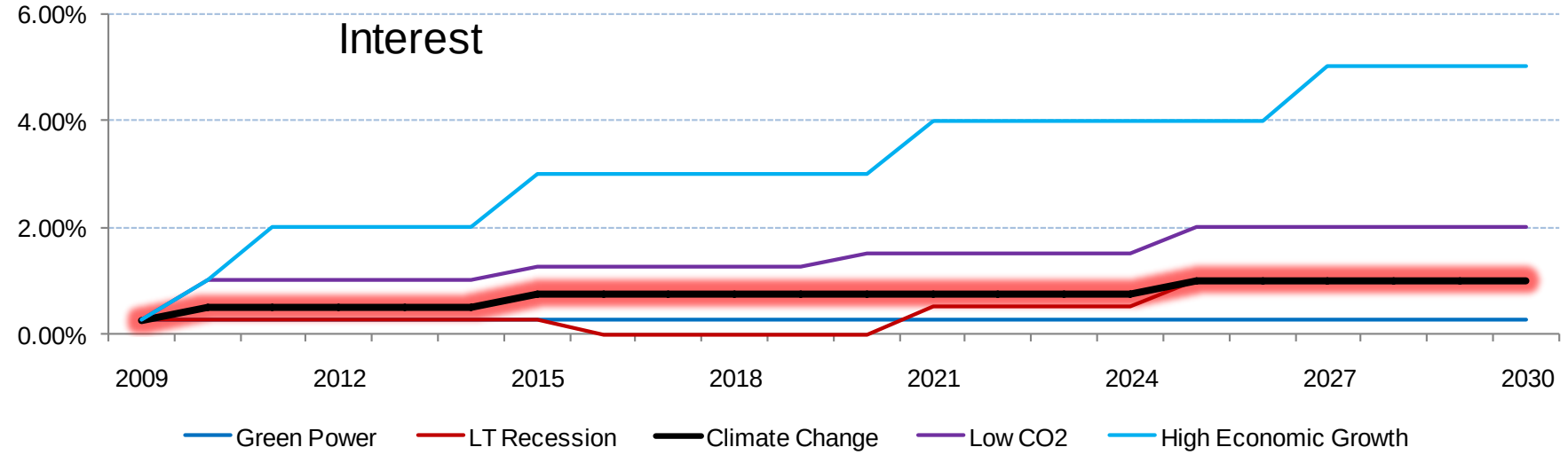
Green Power and High Economic Growth have the same employment values

Coal Exports



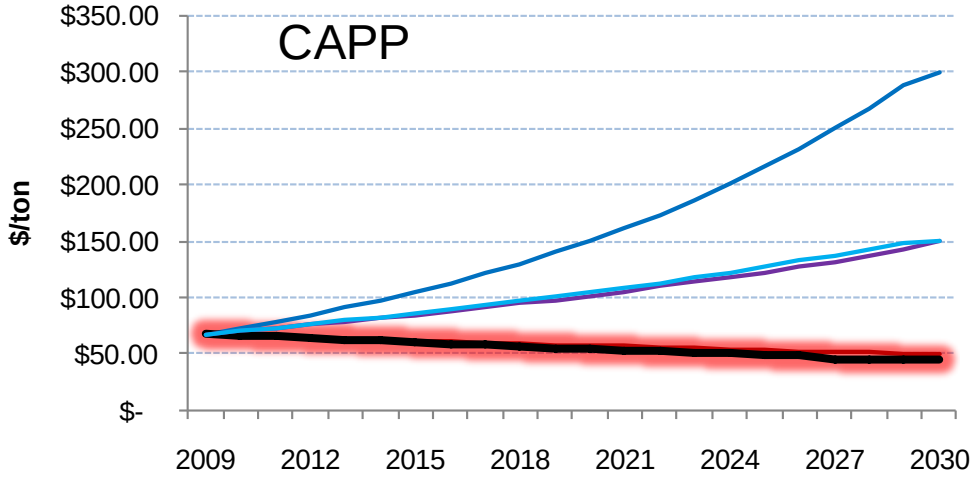
Inflation and Interest Rate Comparison

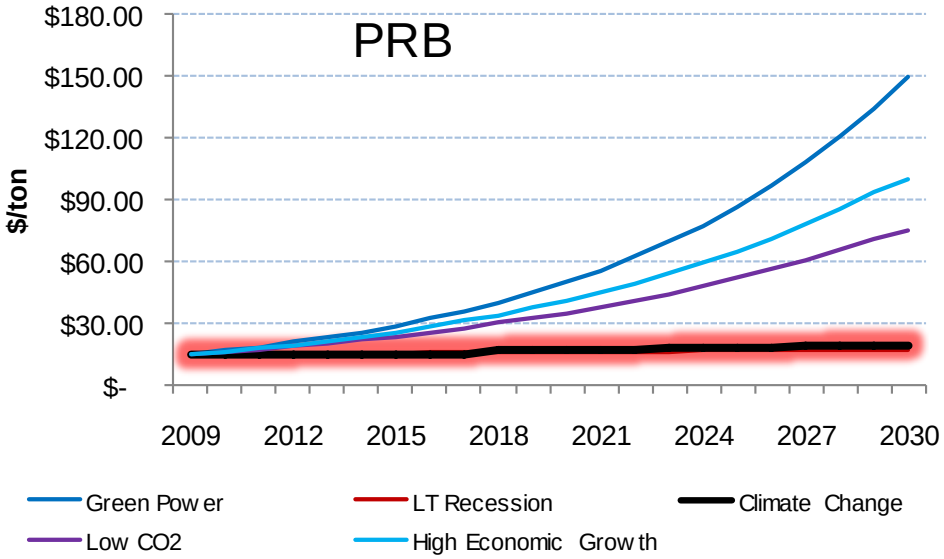




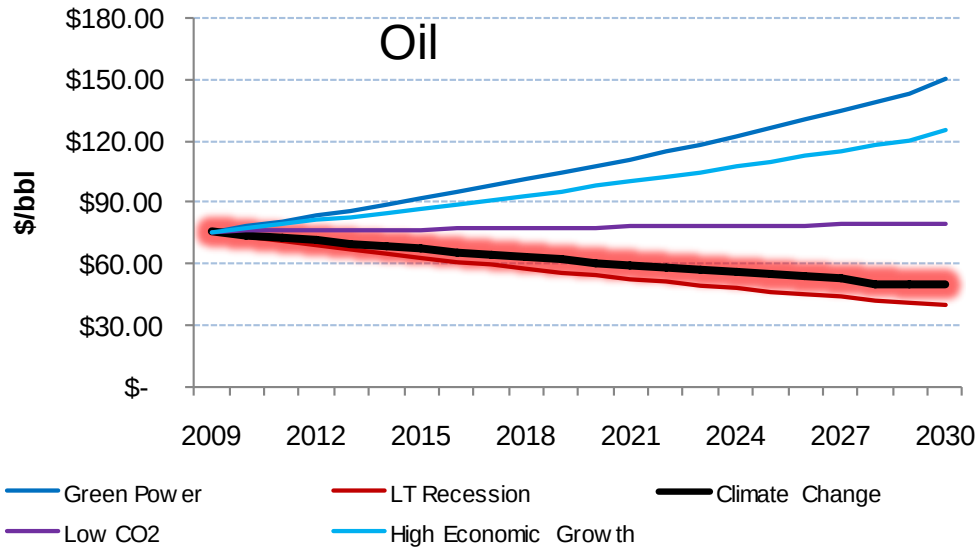
Fuel Price Comparison

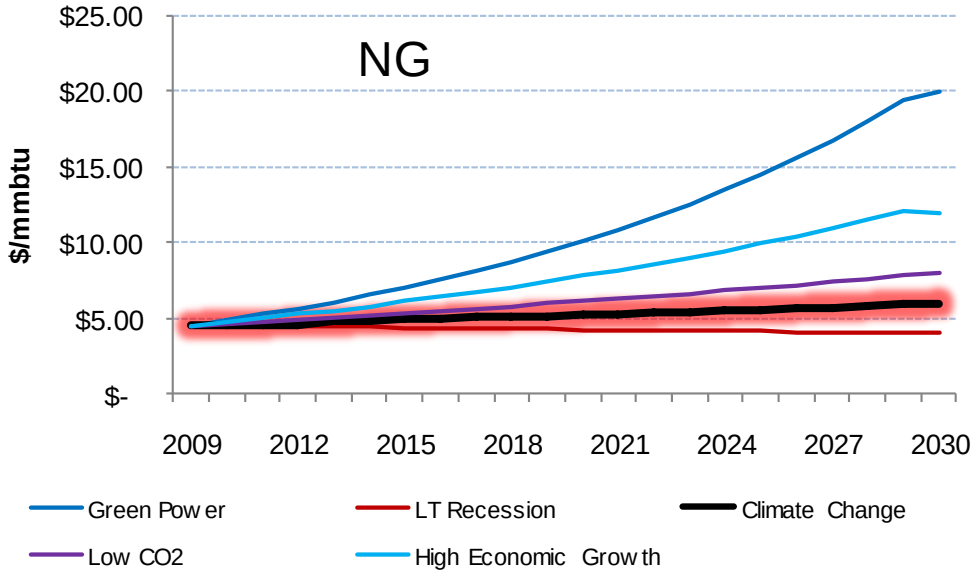
Climate Change





Fuel Price Comparison





Planning Assumptions

GDP	2010	2015	2020	2025	2030
World	3%	2.5%	2.3%	2.8%	2.8%
U.S.	2%	2%	4%	3%	3%
Rest of OECD	4%	3.3%	3%	3.0%	2.8%
BRIC	4%	3.0%	3%	2.5%	2.5%
Texas	3%	3%	4%	4%	4%
Macroeconomics					
U.S. Interest Rate (LIBOR)	0.50%	0.75%	0.75%	1%	1%
U.S. Inflation Rate	-0.5%	5%	5.50%	6%	6%
U.S. Tax Rate	35%	35%	35%	35%	35%
Non-Farm Employment Texas (millions)	10.54	11.71	12.89	14.06	15
Commodities (2010$)					
Crude Oil ($/bbl)	$ 74.19	$ 67.06	$ 60.62	$ 54.79	$ 50
Natural Gas ($/mmbtu)	$ 4.62	$ 4.93	$ 5.26	$ 5.61	$ 6
Central Appalachian ($/ton)	$ 66.49	$ 60.10	$ 54.33	$ 49.11	$ 45
Central Appalachian Heat Content (btu/lb)	12,000	12,000	12,000	12,000	12,000
Central Appalachian ($/mmbtu)	$ 2.77	$ 2.50	$ 2.26	$ 2.05	$ 1.88
PRB ($/ton)	$ 15.44	$ 16.43	$ 17.48	$ 18.60	$ 20
PRB Heat Content	8,800	8,800	8,800	8,800	8,800
PRB ($/mmbtu)	$ 0.88	$ 0.93	$ 0.99	$ 1.06	$ 1.14
U.S. Coal Exports (millions of tons per year)	80	75	75	50	50
Annual Emissions Costs ($/ton)					
NOx	$ 515	$ 600	$ 750	$ 1,000	$ 1,000
SO2	$ 6.00	$ 750	$ 1,500	$ 2,500	$ 3,000
CO2	$ -	$ 100	$ 200	$ 300	$ 300
Capital Costs ($/kW)					
Nuclear	$ 5,750	$ 5,500	$ 5,000	$ 4,500	$ 4,000
Coal with CCS	$ 4,500	$ 4,750	$ 5,000	$ 5,000	$ 5,000
Supercritical Coal	N/A	N/A	N/A	N/A	N/A
Natural Gas Combined Cycle	$ 1,000	$ 1,200	$ 1,200	$ 1,200	$ 1,200
Natural Gas Peaking Facility	$ 750	$ 850	$ 900	$ 1,000	$ 1,000
Wind Turbine	$ 2,000	$ 2,000	$ 2,250	$ 2,000	$ 1,500
Geothermal	$ 4,250	$ 4,000	$ 3,750	$ 3,500	$ 3,000
Solar Farms	$ 5,000	$ 4,500	$ 3,000	$ 2,500	$ 2,500

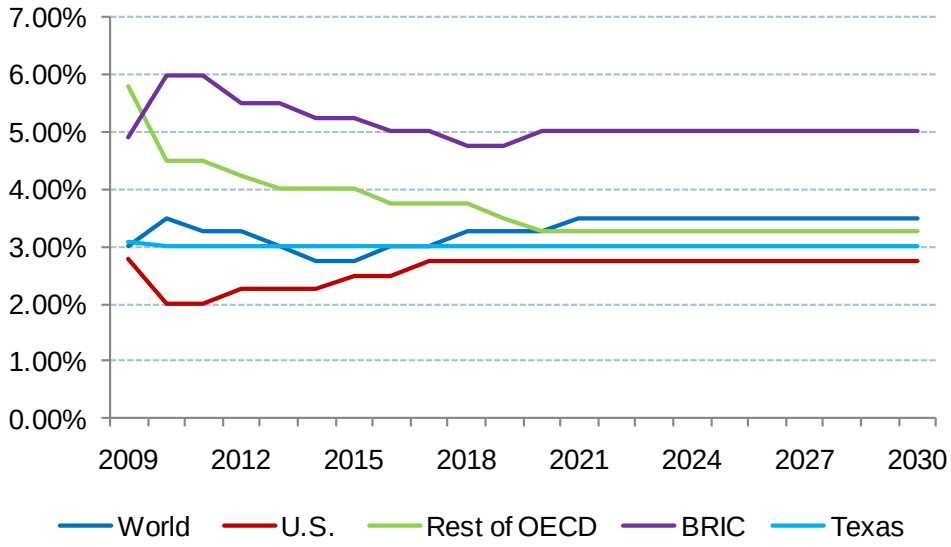
"Low CO_2 Concerns" Scenario

- **US / World Impact**
  - World concern for the environment declines
  - No or limited national CO_2 program
  - Coal prices increase due to demand both internally and externally
  - US exports of coal increase significantly

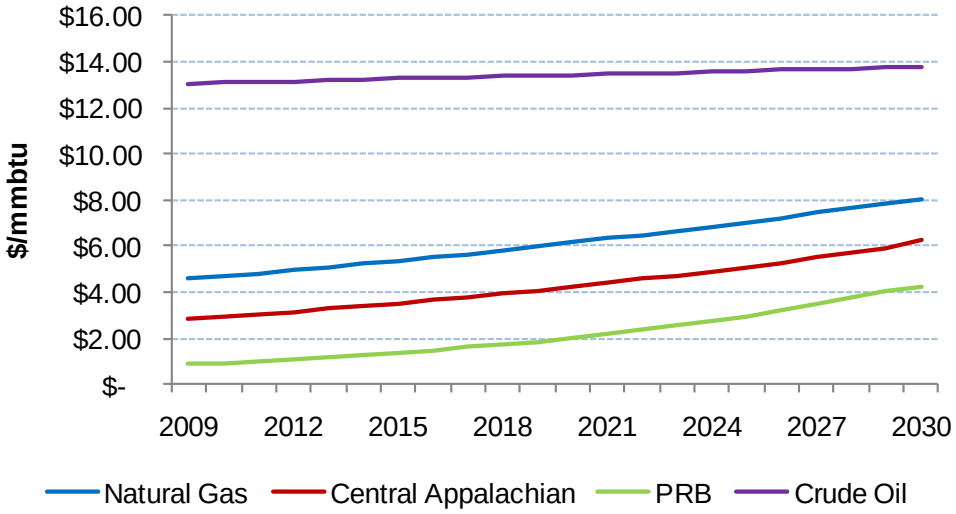
- **Texas Impact**
  - Texas continues building wind but also adds more coal generation.
  - Development of all renewables slows down
  - Demand growth continues at recent historic levels
  - Future mix of resources will look like today
    - Coal and natural gas resources will be primary

Scenario GDP and Fuel Prices

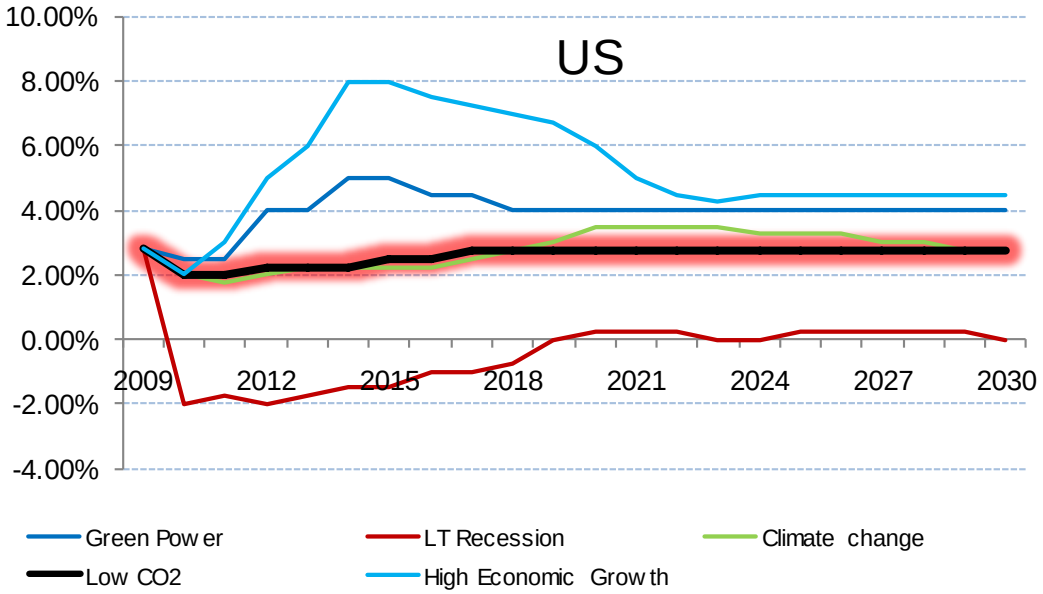
Low CO2 Concerns

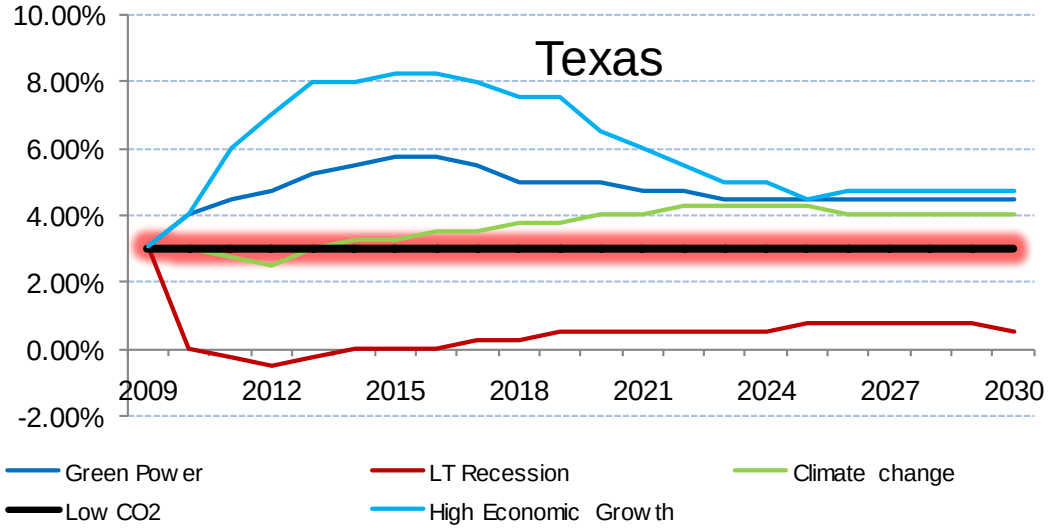


Fossil fuel prices will climb due to worldwide demand

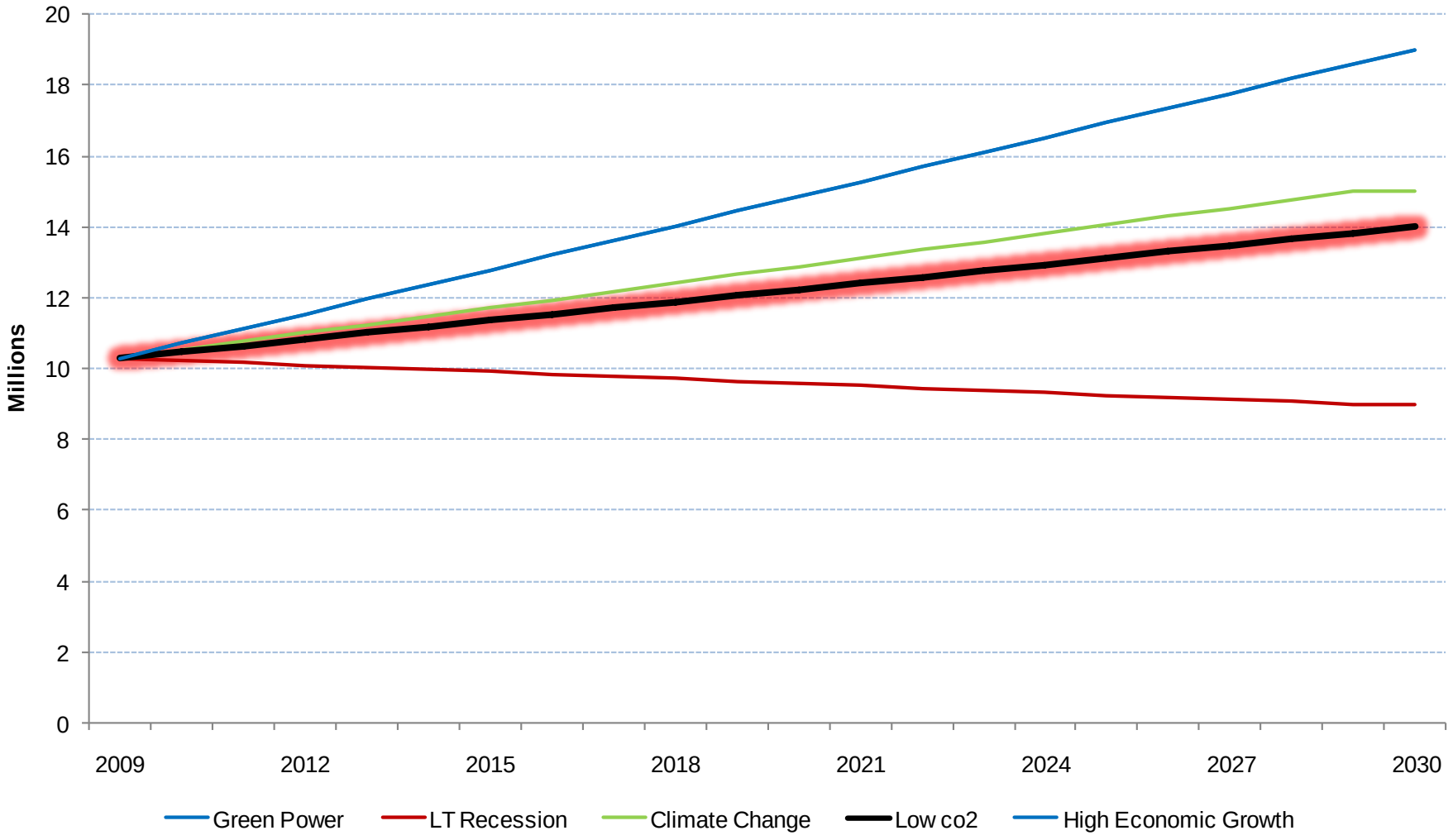


GDP Comparison



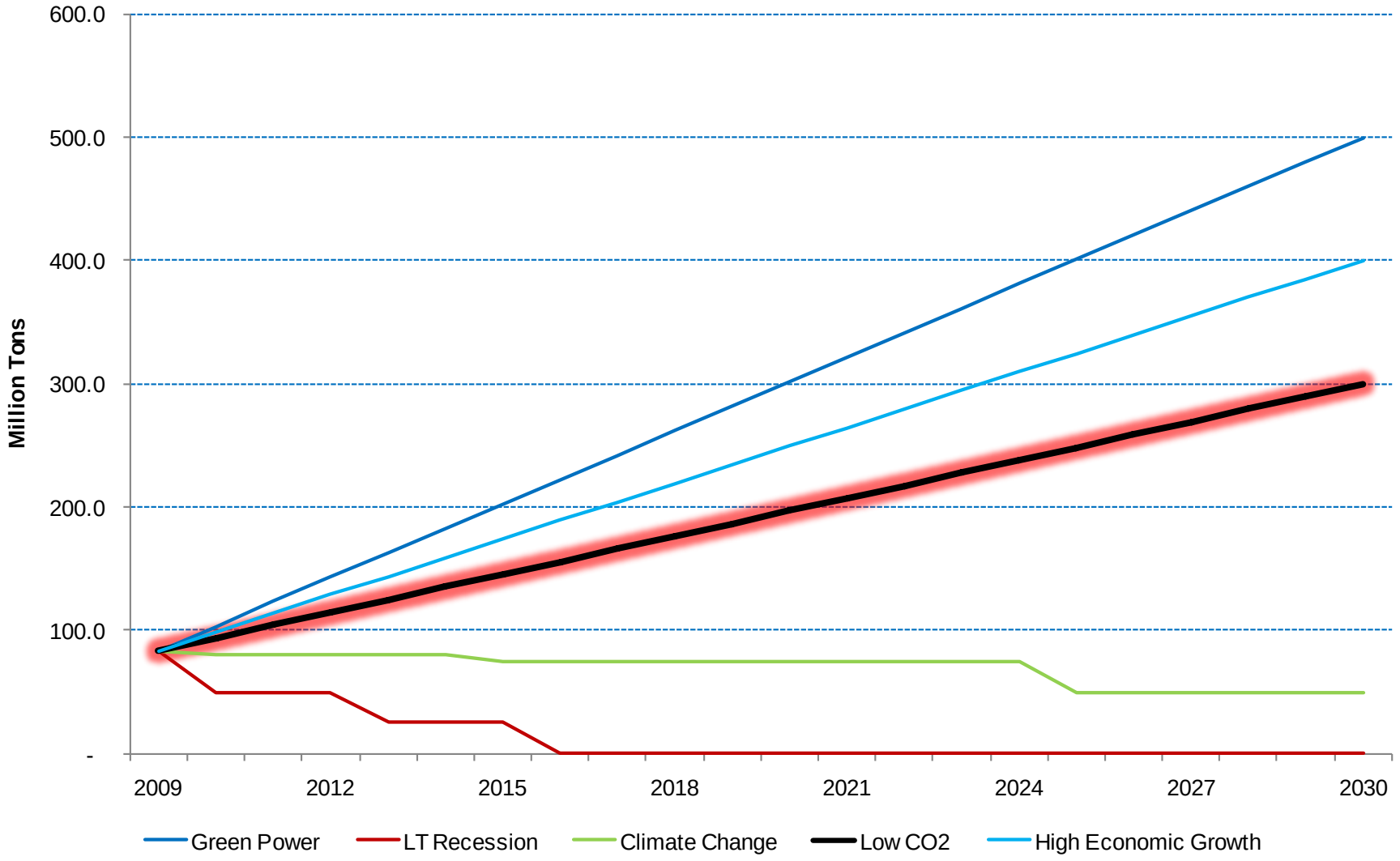


Texas Employment



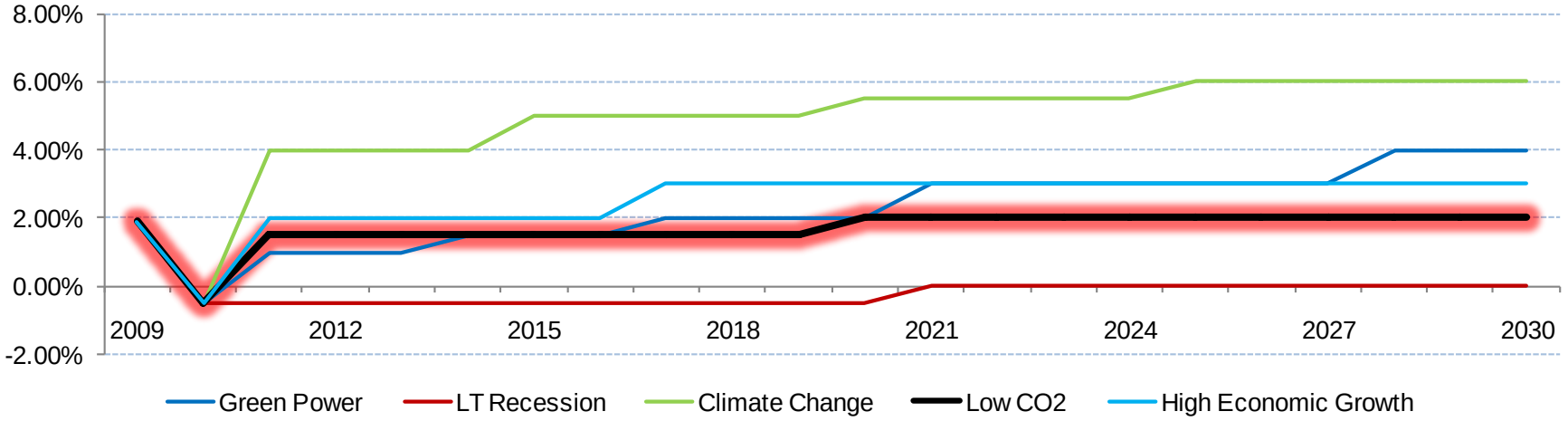
Green Power and High Economic Growth have the same employment values

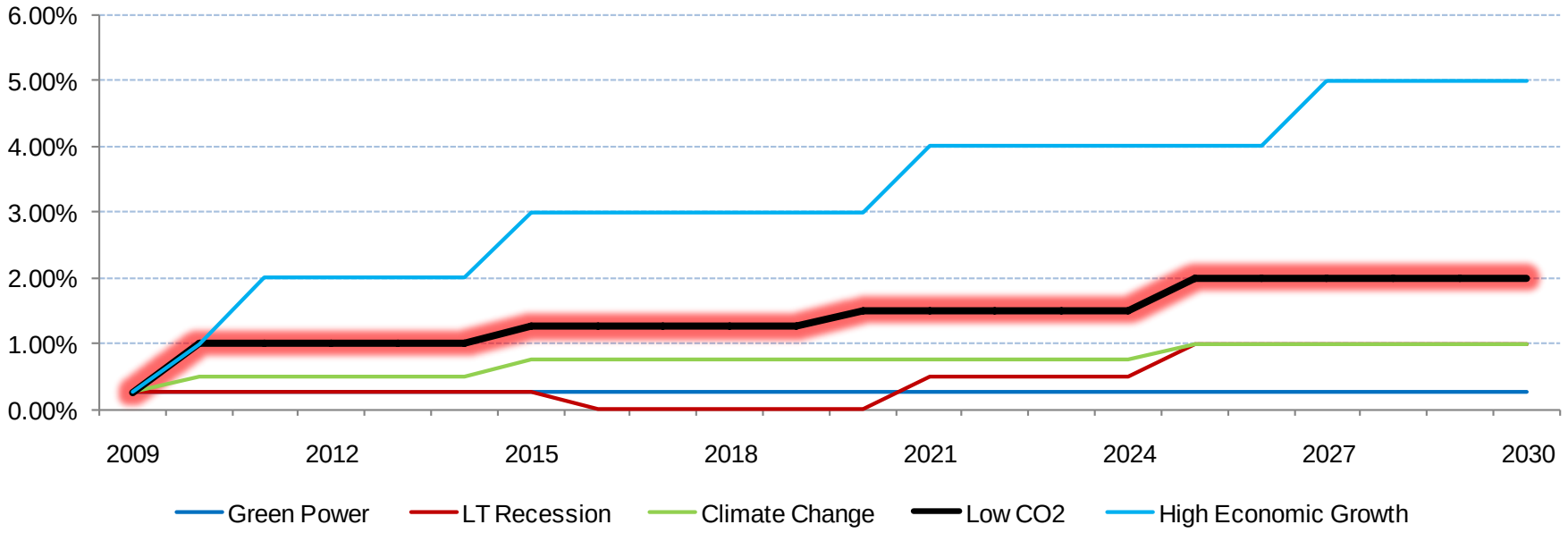
Coal Exports



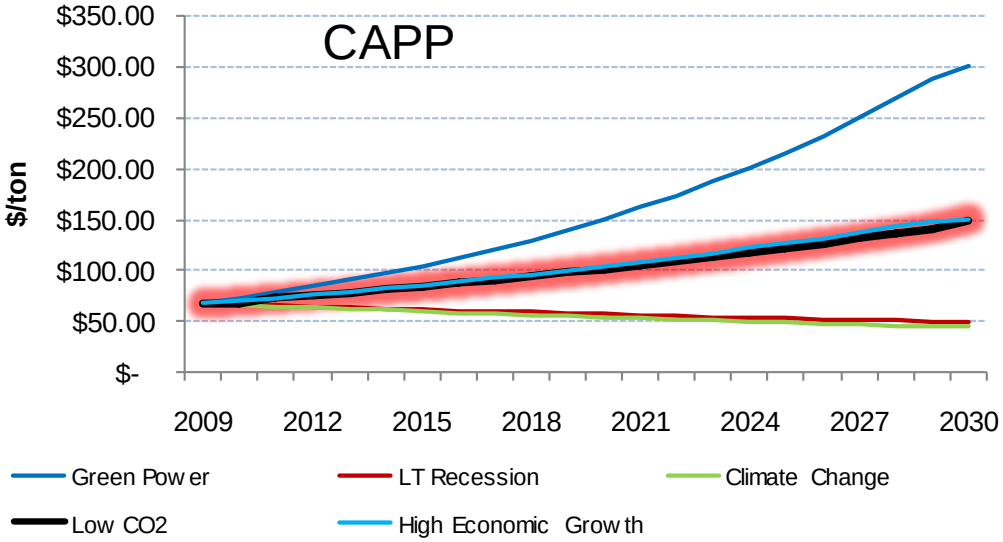
Inflation and Interest Rate Comparison

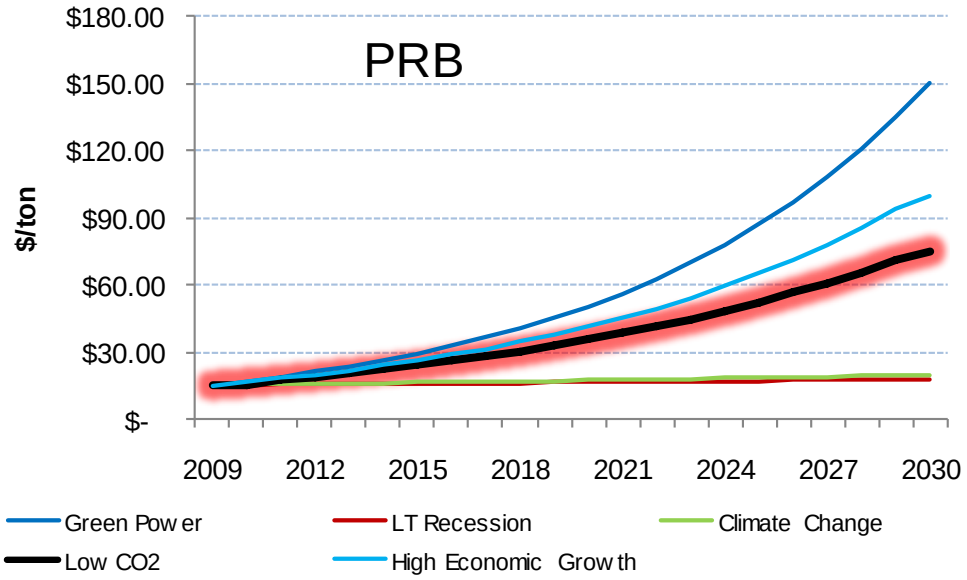
Low CO2 Concerns





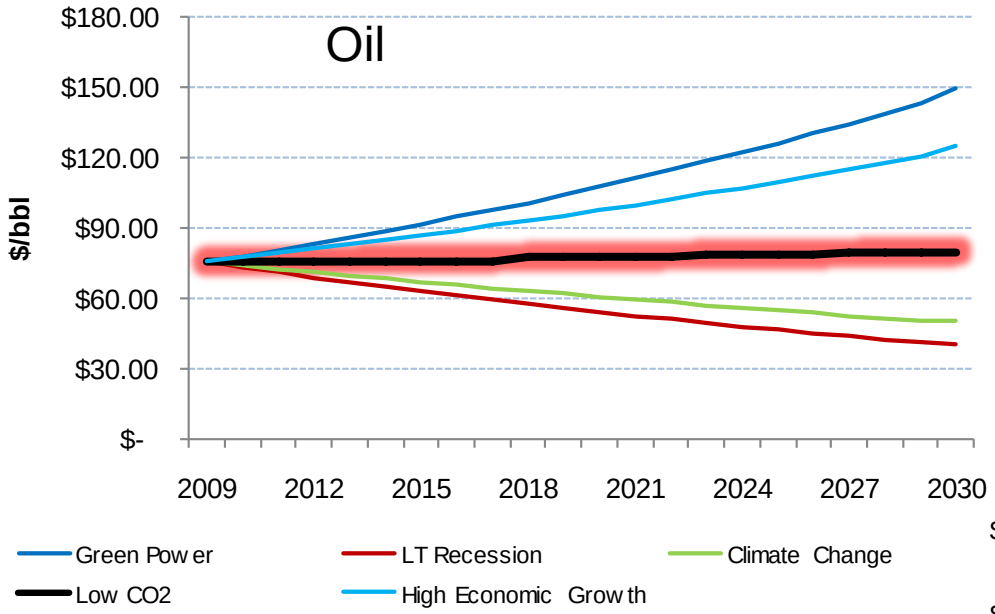
Fuel Price Comparison

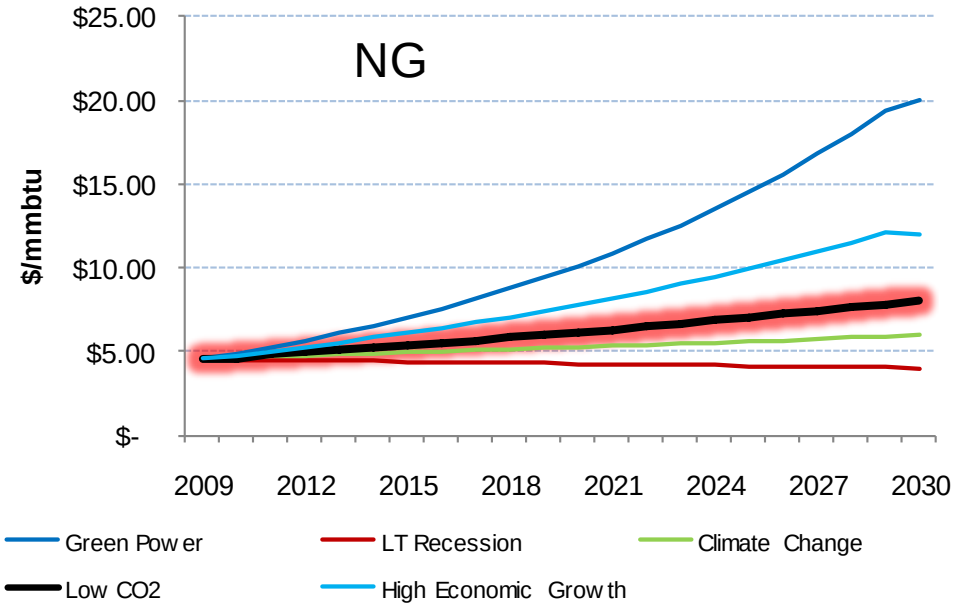




High coal exports and continued US consumption keep prices rising

Fuel Price Comparison





Planning Assumptions

Low CO2 Concerns

GDP	2010	2015	2020	2025	2030
World	4%	3%	3%	4%	4%
U.S.	2%	3%	3%	3%	3%
Rest of OECD	5%	4%	3%	3%	3%
BRIC	6%	5%	5%	5%	5%
Texas	3%	3%	3%	3%	3%
Macroeconomics					
U.S. Interest Rate (LIBOR)	1%	1.25%	1.50%	2%	2%
U.S. Inflation Rate	-0.50%	1.50%	2%	2%	2%
U.S. Tax Rate	35%	35%	35%	35%	35%
Non-Farm Employment Texas (millions)	10.48	11.36	12.24	13.12	14.00
Commodities (2010$)					
Crude Oil ($/bbl)	$ 75.89	$ 76.84	$ 77.81	$ 78.79	$ 80
Natural Gas ($/mmbtu)	$ 4.69	$ 5.37	$ 6.15	$ 7.04	$ 8
Central Appalachian ($/ton)	$ 70.39	$ 84.62	$ 101.72	$ 122.28	$ 150
Central Appalachian Heat Content (btu/lb)	12,000	12,000	12,000	12,000	12,000
Central Appalachian ($/mmbtu)	$ 2.93	$ 3.53	$ 4.24	$ 5.10	$ 6.25
PRB ($/ton)	$ 16.47	$ 24.20	$ 35.56	$ 52.25	$ 75
PRB Heat Content	8,800	8,800	8,800	8,800	8,800
PRB ($/mmbtu)	$ 0.94	$ 1.37	$ 2.02	$ 2.97	$ 4.26
U.S. Coal Exports (millions of tons per year)	93.81	145.36	196.90	248.45	300
Annual Emissions Costs ($/ton)					
NOx	$ 515	$ 450	$ 400	$ 350	$ 300
SO2	$ 6.00	$ 30	$ 50	$ 60	$ 60
CO2	$ -	$ 10	$ 15	$ 20	$ 20
Capital Costs ($/kW)					
Nuclear	$ 6,000	$ 6,000	$ 6,000	$ 6,000	$ 6,000
Coal with CCS	$ 4,500	$ 4,250	$ 4,000	$ 3,750	$ 3,500
Supercritical Coal	$ 3,500	$ 3,500	$ 3,500	$ 3,500	$ 3,500
Natural Gas Combined Cycle	$ 900	$ 900	$ 900	$ 900	$ 900
Natural Gas Peaking Facility	$ 800	$ 800	$ 800	$ 800	$ 800
Wind Turbine	$ 2,500	$ 2,500	$ 2,500	$ 2,500	$ 2,500
Geothermal	$ 4,250	$ 4,000	$ 3,750	$ 3,500	$ 3,000
Solar Farms	$ 5,000	$ 4,950	$ 4,900	$ 4,850	$ 4,800

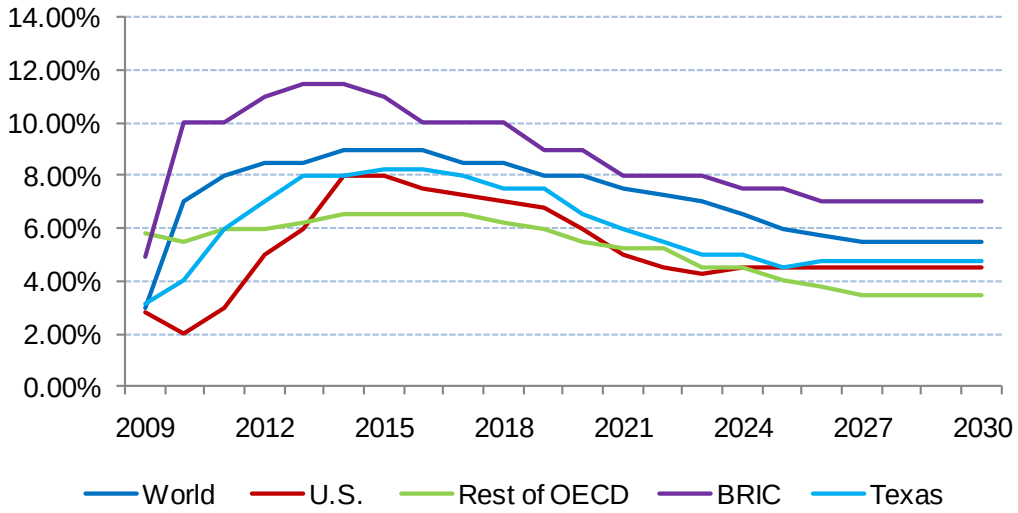
"High Economic Growth" Scenario

- **US / World Impact**
  - World economy is booming
  - This will be marked by high GDP in the US for 4 to 5 years then returning to 3% to 4% range thereafter
  - All fuel prices will rise due to demand
  - Development of renewable energy as well as conventional resources will be strong to meet demand growth

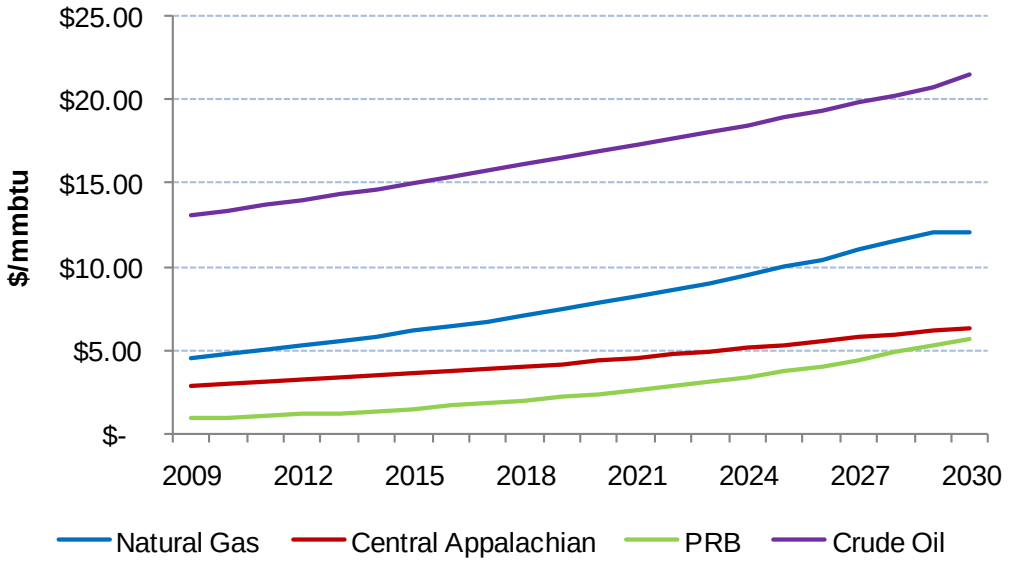
- **Texas Impact**
  - Texas growth is strong on all fronts
  - Continued reduction in prices for all renewables
  - Growth in demand for all generating types due to load growth
  - Increase in quick start capability or other reliability measures due to increase intermittent generation
    - Batteries
    - Flywheels
    - Other storage technologies

Scenario GDP and Fuel Prices

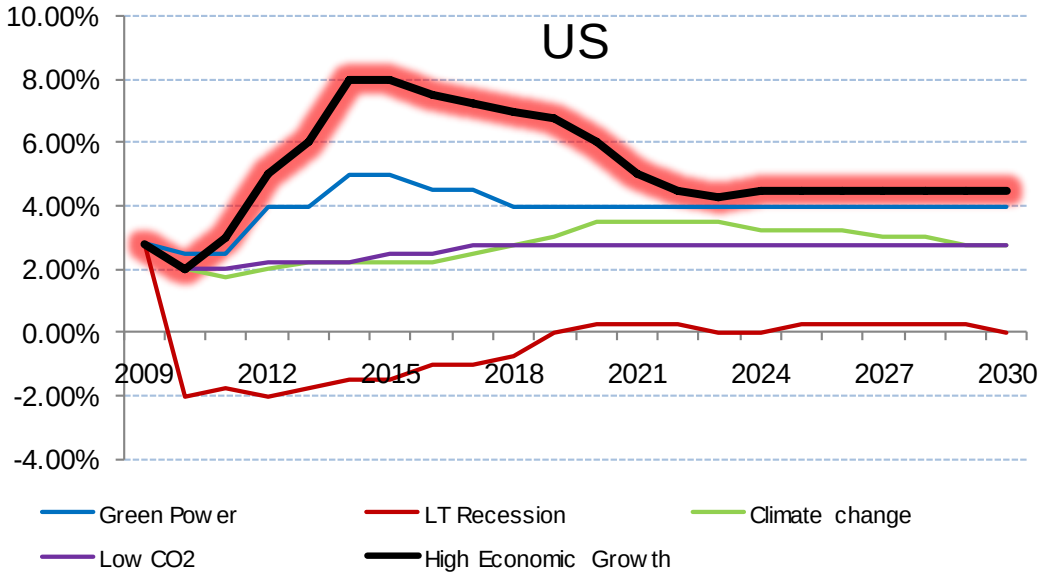
High Economic Growth



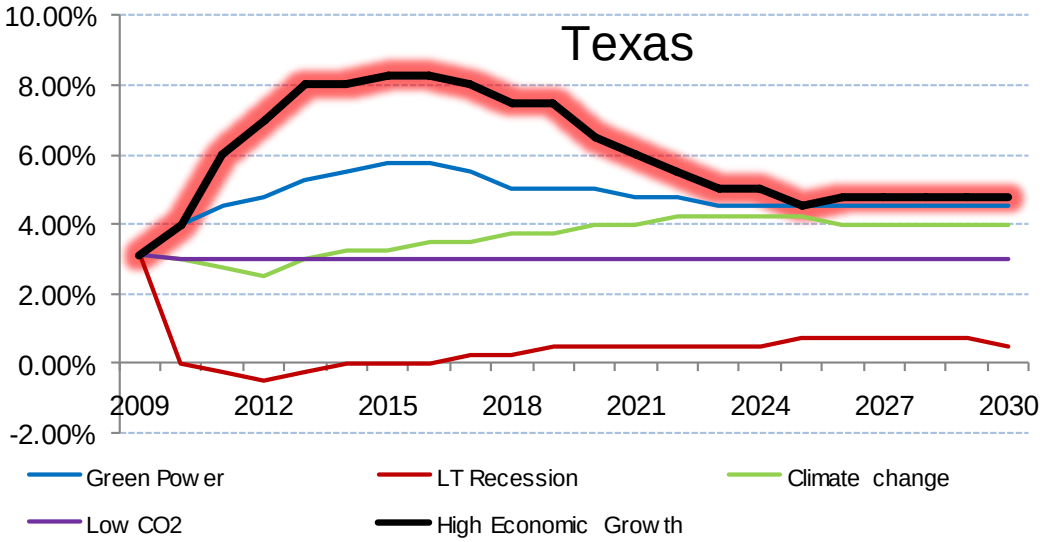
GDP rates will be high for most regions of the world in the early years



GDP Comparison

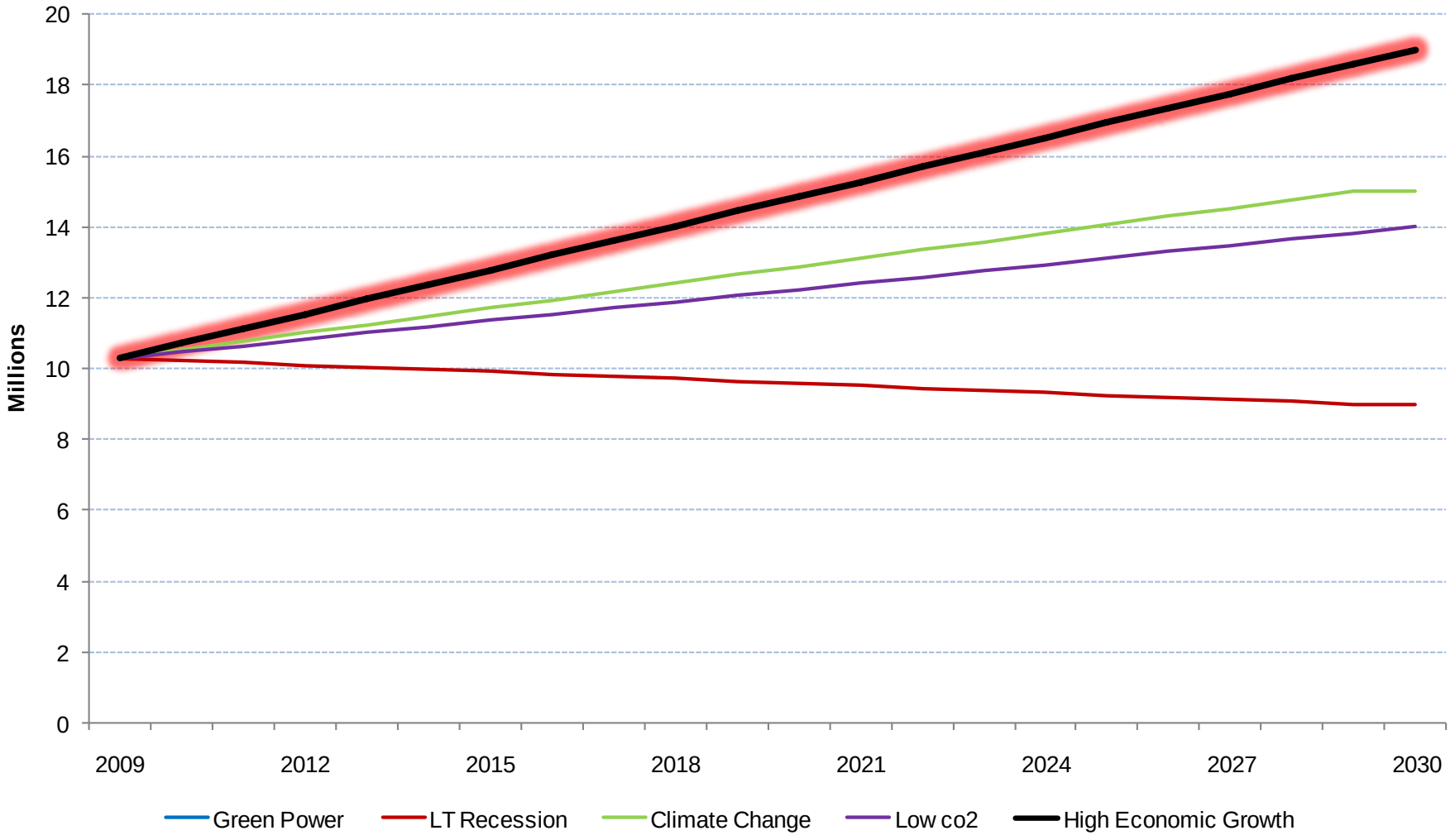


Texas growth remains strong for an extended period



Texas Employment

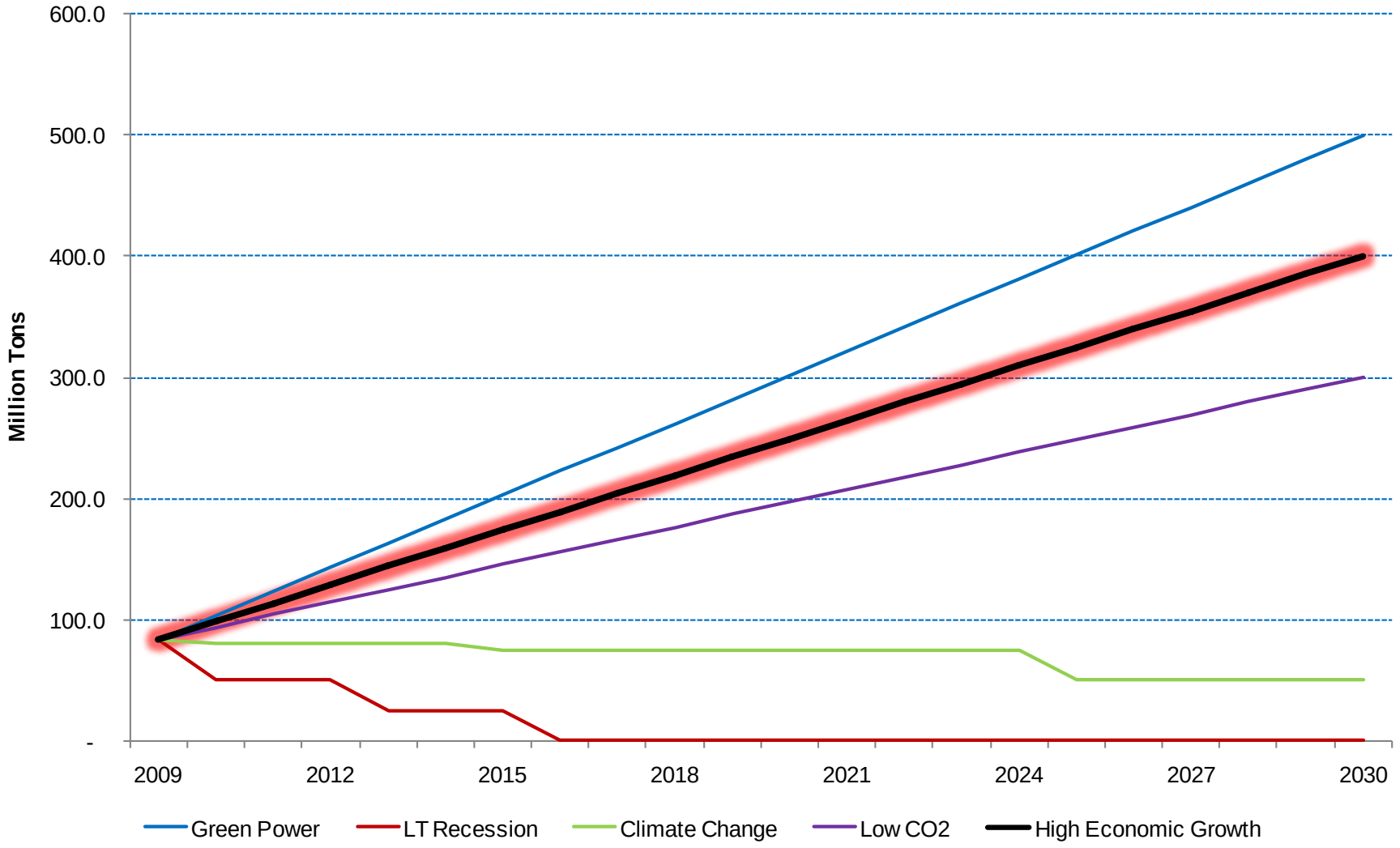
High Economic Growth



Green Power and High Economic Growth have the same employment values

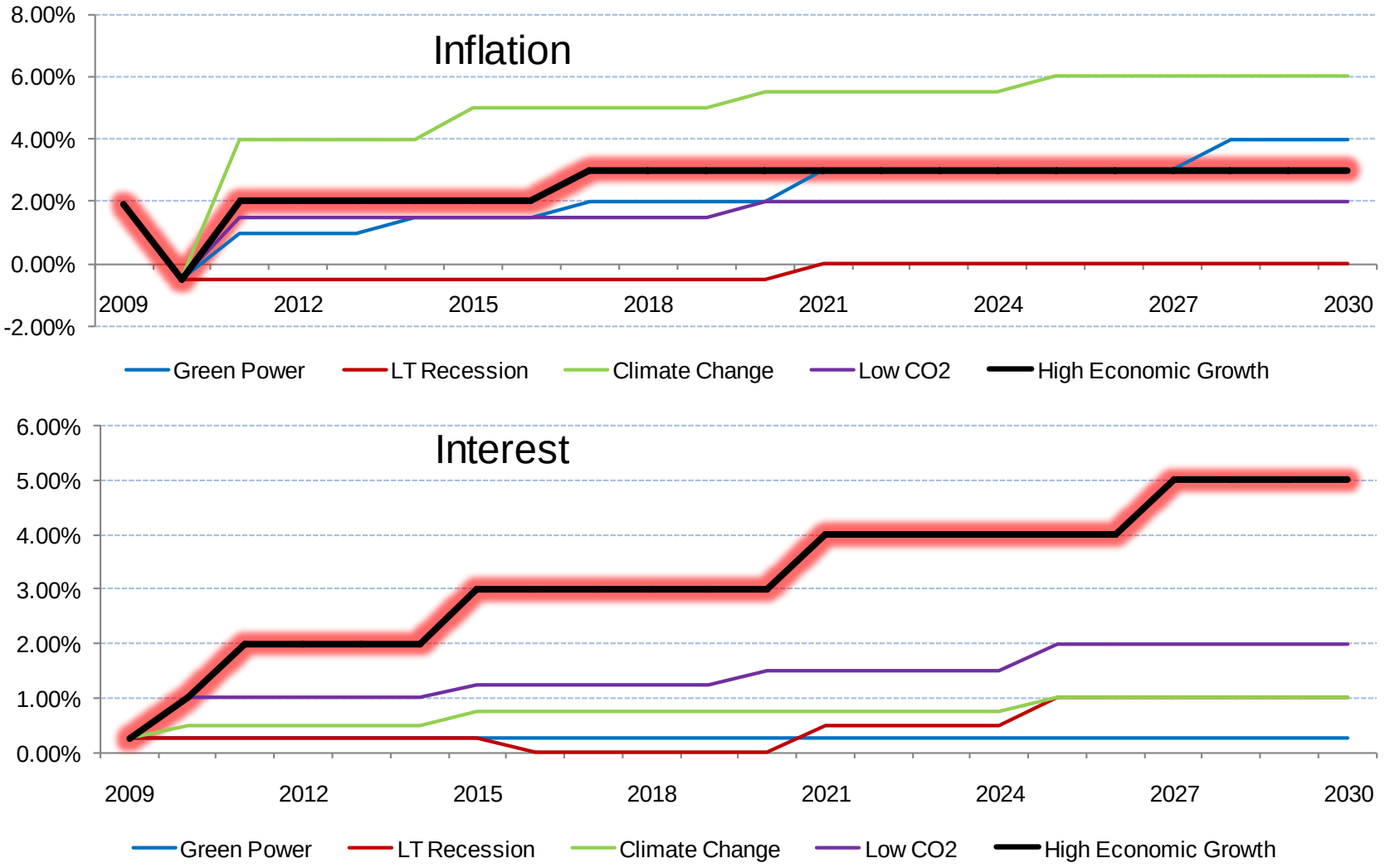
Coal Exports

High Economic Growth



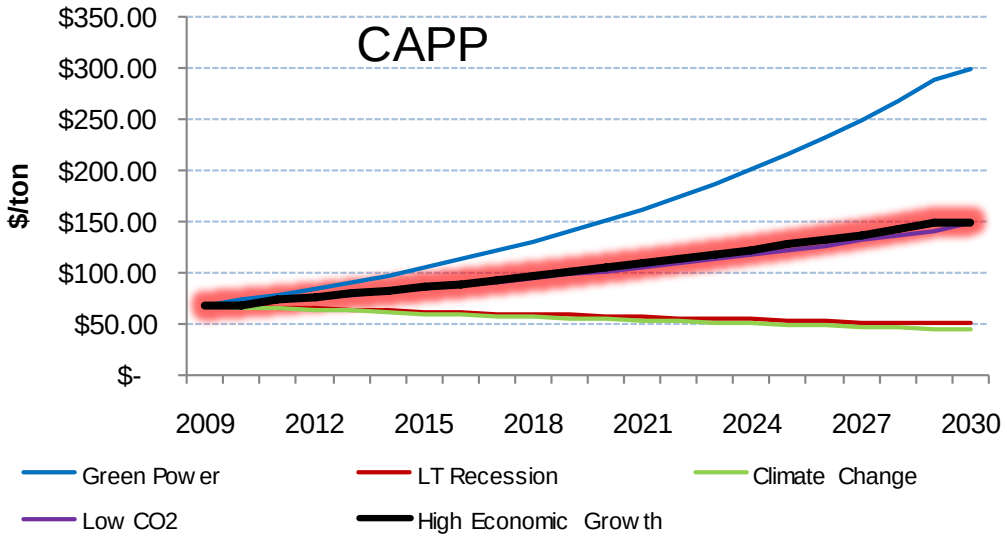
Inflation and Interest Rate Comparison

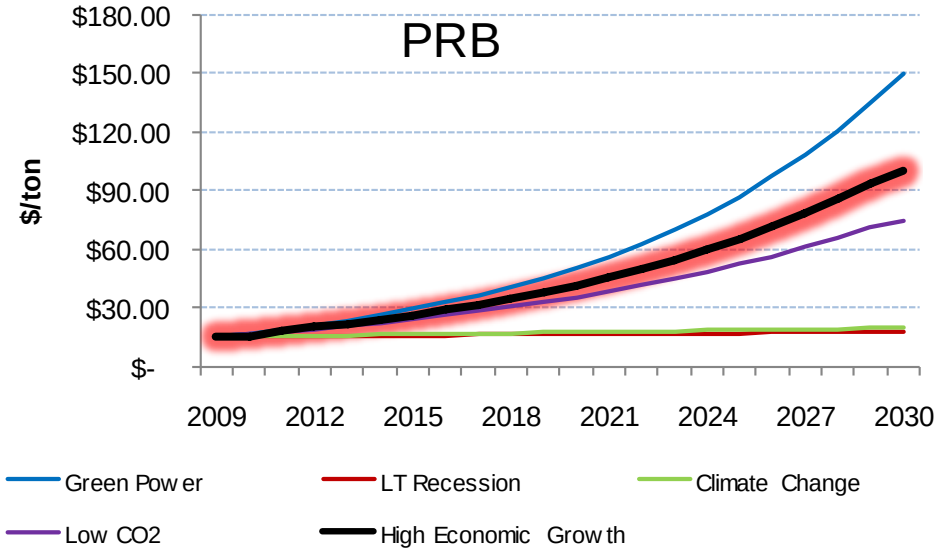
High Economic Growth



Fuel Price Comparison

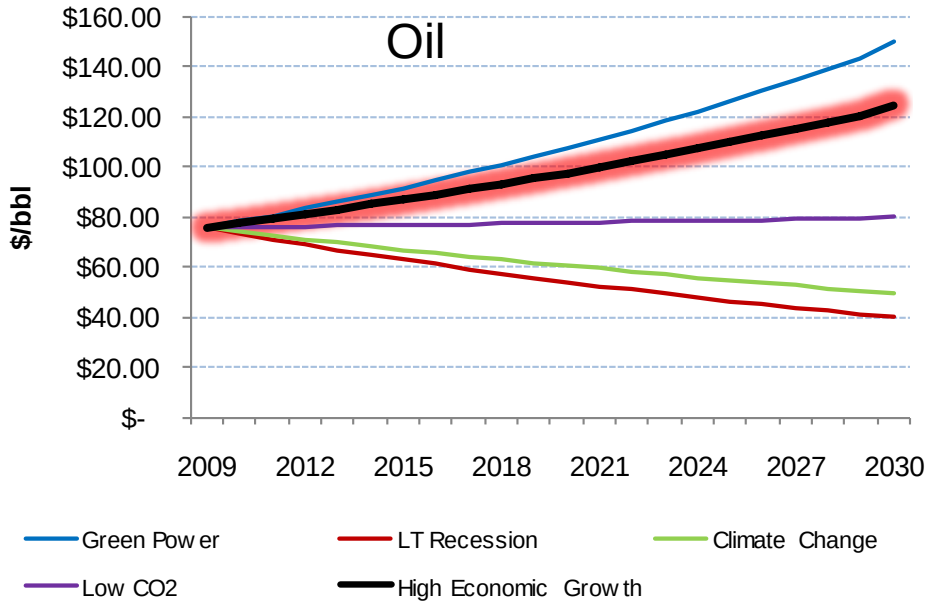
High Economic Growth

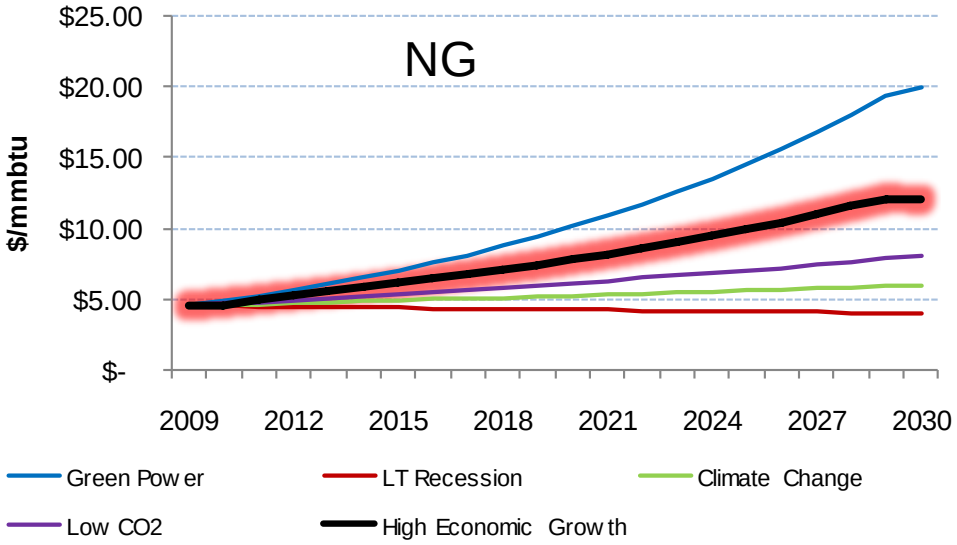




Fuel Price Comparison

High Economic Growth



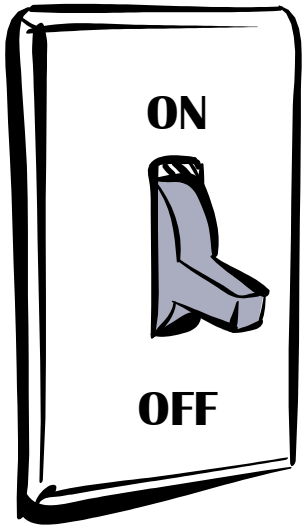


Planning Assumptions

High Economic Growth

GDP	2010	2015	2020	2025	2030
World	7%	9%	8%	6%	6%
U.S.	2%	8%	6%	4.5%	4.5%
Rest of OECD	6%	7%	6%	4%	4%
BRIC	10%	11%	9%	8%	7%
Texas	4%	8%	7%	5%	5%
Macroeconomics					
U.S. Interest Rate (LIBOR)	1%	3%	3%	4%	5%
U.S. Inflation Rate	-0.5%	2%	3%	3%	3%
U.S. Tax Rate	35%	35%	35%	35%	35%
Non-Farm Employment Texas (millions)	10.71	12.79	14.86	16.93	19
Commodities (2010$)					
Crude Oil ($/bbl)	$ 77.48	$ 87.02	$ 97.74	$ 109.77	$ 125
Natural Gas ($/mmbtu)	$ 4.79	$ 6.11	$ 7.80	$ 9.95	$ 12
Central Appalachian ($/ton)	$ 70.56	$ 85.85	$ 104.45	$ 127.08	$ 150
Central Appalachian Heat Content (btu/lb)	12,000	12,000	12,000	12,000	12,000
Central Appalachian ($/mmbtu)	$ 2.94	$ 3.58	$ 4.35	$ 5.30	$ 6.25
PRB ($/ton)	$ 16.70	$ 26.29	$ 41.38	$ 65.15	$ 100
PRB Heat Content	8,800	8,800	8,800	8,800	8,800
PRB ($/mmbtu)	$ 0.95	$ 1.49	$ 2.35	$ 3.70	$ 5.68
U.S. Coal Exports (millions of tons per year)	98.57	173.93	249.29	324.64	400
Annual Emissions Costs ($/ton)					
NOx	$ 515	$ 575	$ 600	$ 650	$ 700
SO2	$ 6.00	$ 30	$ 50	$ 60	$ 60
CO2	$ -	$ 15	$ 20	$ 25	$ 25
Capital Costs ($/kW)					
Nuclear	$ 6,000	$ 6,000	$ 5,910	$ 5,480	$ 5,081
Coal with CCS	$ 4,500	$ 4,000	$ 3,500	$ 3,000	$ 3,000
Supercritical Coal	$ 3,500	$ 3,000	$ 2,500	$ 2,500	$ 2,500
Natural Gas Combined Cycle	$ 900	$ 900	$ 900	$ 900	$ 900
Natural Gas Peaking Facility	$ 800	$ 800	$ 800	$ 800	$ 800
Wind Turbine	$ 2,000	$ 1,900	$ 1,800	$ 1,700	$ 1,700
Geothermal	$ 4,500	$ 4,000	$ 3,500	$ 3,000	$ 3,000
Solar Farms	$ 4,940	$ 3,822	$ 2,958	$ 2,289	$ 1,771

Questions



Contact Information

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