



# Scenario Development

Doug Murray

January 2011

# Scenario Development

---

## **Goal: Develop long range (20 yr) transmission plan**

- **Start with 5YTP which includes:**

- CREZ transmission
- Houston Import
- Other transmission improvements – Board approved
- Generation additions – with Interconnection agreements as of February 28<sup>th</sup>

## **Question: What would cause a change to the transmission configuration?**

- **Major considerations will be:**

- Load growth
- New green-field generation
- New technologies with differing operational considerations (wind, solar, storage, demand response)
- Natural Gas Prices

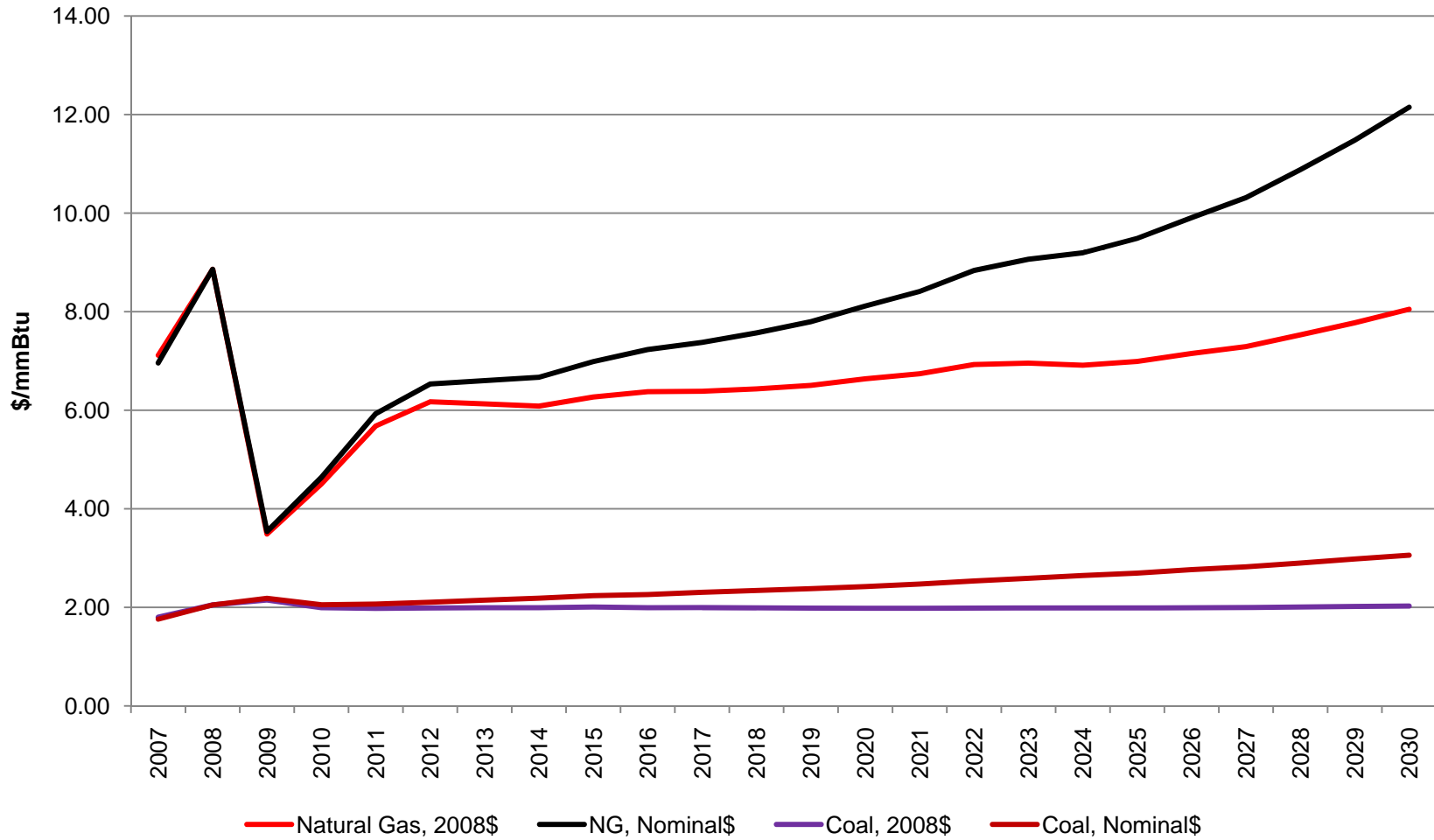
# Business As Usual Scenario

---

- **Business As Usual scenario (BAU) – BAU Scenario is characterized by continuation of historic market trends and policies**
- **This scenario will assist in the development of processes and procedures to be used in later analysis**
- **Will include:**
  - All info from 5YTP
  - Continue production tax credit
  - Inclusion of new generating technologies will also be considered based on economics
  - Additional capacity will be based on projections of future costs
  - Use market intelligence to fine tune generation expansion
  - Fuel price assumptions will be based on latest EIA forecasts
- **Generation and Transmission system expansion will be developed for 2020, 2025, 2030**

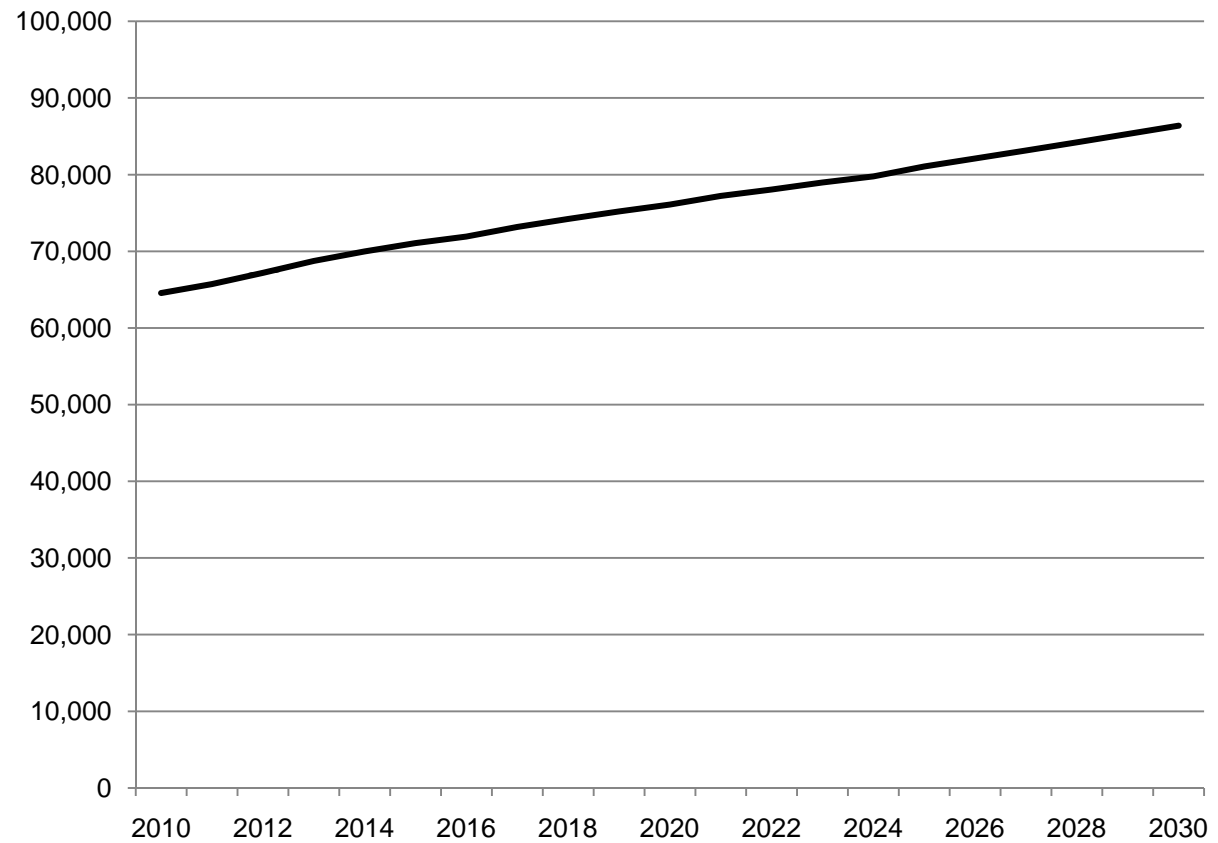
# Fuel Price Assumptions for BAU Scenario

- **EIA 2010 Annual Energy Outlook**
- **May be updated with 2011 Outlook**



# Load Forecast Assumptions for BAU Scenario

| Year | Peak   |
|------|--------|
| 2010 | 64,558 |
| 2011 | 65,719 |
| 2012 | 67,178 |
| 2013 | 68,725 |
| 2014 | 69,991 |
| 2015 | 71,063 |
| 2016 | 71,927 |
| 2017 | 73,176 |
| 2018 | 74,229 |
| 2019 | 75,200 |
| 2020 | 76,099 |
| 2021 | 77,218 |
| 2022 | 78,063 |
| 2023 | 78,982 |
| 2024 | 79,763 |
| 2025 | 81,077 |
| 2026 | 82,111 |
| 2027 | 83,159 |
| 2028 | 84,220 |
| 2029 | 85,294 |
| 2030 | 86,382 |



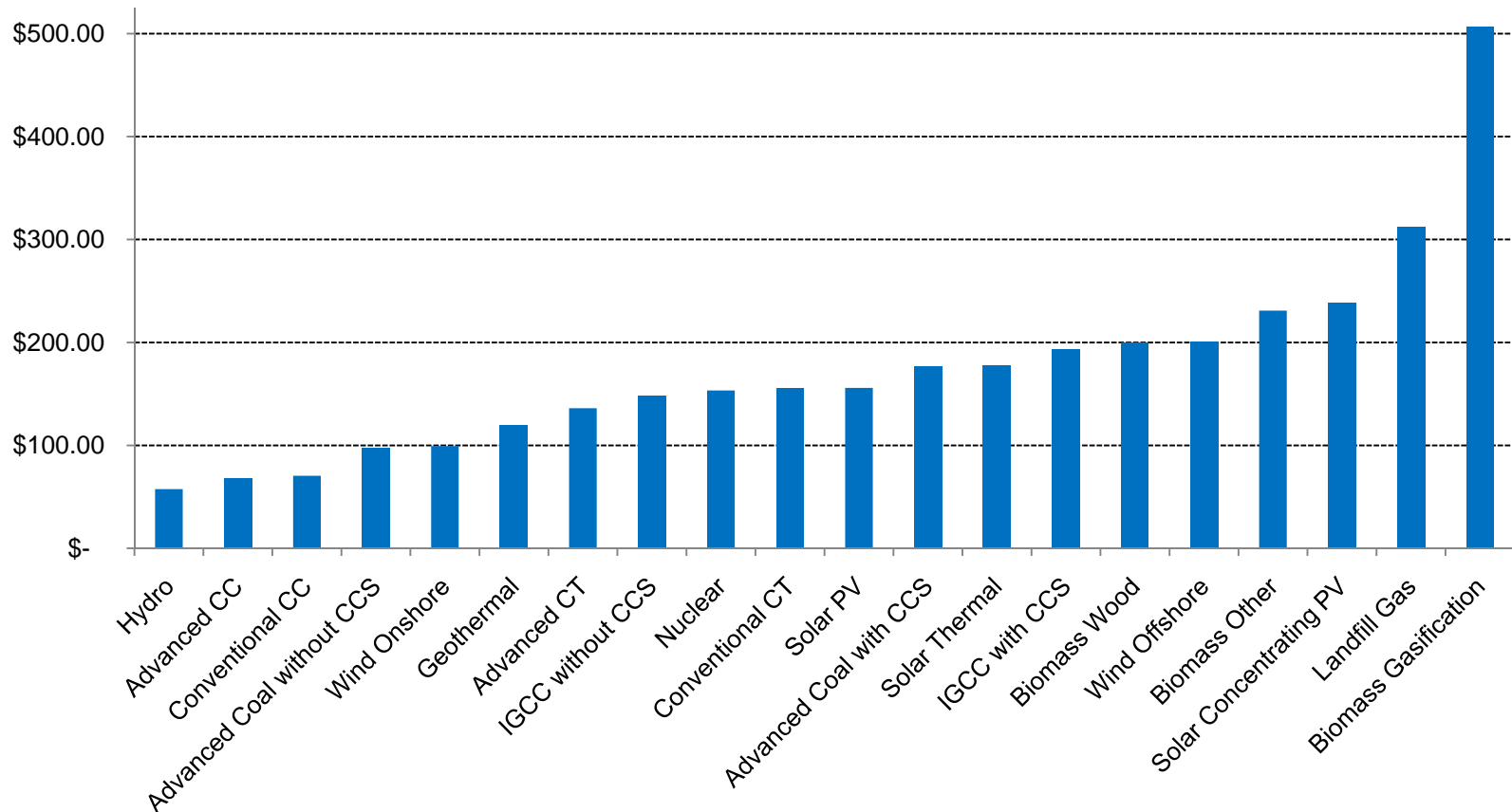
# Business As Usual Scenario

---

- **Capacity expansion development**
  - This will likely be an iterative process
    - Use MarketPower output for economic expansion and retirements
    - Use levelized cost analysis to guide decision on expansion units
  - Assess expansion generation types on system base, intermediate, and peaking MW needs
  - Run PROMOD model to examine results with expansion plan
    - What do unit economics look like?
    - What does system congestion look like?
  - Model results will dictate next steps
- **Generation expansion based on what we already understand will help in determining if model is operating correctly**
- **This process will also assist in the development of how results will be analyzed**

# Levelized Cost of Energy for BAU Scenario

- **Current 2010 values**
- **Costs will be develop for 2020, 2025, 2030**



---

# Questions?



## Levelized Cost Model Assumptions (2010\$) – Latest EIA Data

| Technology           | Capacity (MW) | Capacity Factor | Heat Rate (Btu/kWh) | Capital (\$/kW) | Plant Life | Fuel Cost (\$/mmBtu) | Fixed O&M (\$/kW) | Var O&M (\$/MWh) |
|----------------------|---------------|-----------------|---------------------|-----------------|------------|----------------------|-------------------|------------------|
| Adv. Coal w/o CCS    | 650           | 78%             | 8,800               | \$2,896         | 20 yrs     | \$2.00               | \$35.97           | \$4.25           |
| Adv. Coal w/ CCS     | 650           | 80%             | 12,000              | \$4,582         | 20 yrs     | \$2.00               | \$77.00           | \$9.00           |
| IGCC w/o CCS         | 600           | 58%             | 8,700               | \$3,271         | 20 yrs     | \$2.00               | \$59.23           | \$6.87           |
| IGCC w/ CCS          | 520           | 58%             | 10,700              | \$4,851         | 20 yrs     | \$2.00               | \$69.30           | \$8.04           |
| Conv. CT             | 85            | 10%             | 10,850              | \$907           | 20 yrs     | \$5.00               | \$14.70           | \$6.98           |
| Adv. CT              | 210           | 10%             | 9,750               | \$673           | 20 yrs     | \$5.00               | \$6.70            | \$9.87           |
| Conv. CC             | 540           | 50%             | 7,050               | \$893           | 20 yrs     | \$5.00               | \$14.39           | \$3.43           |
| Adv. CC              | 540           | 50%             | 6,430               | \$919           | 20 yrs     | \$5.00               | \$14.62           | \$3.11           |
| Nuclear              | 1118          | 90%             | 10,488              | \$5,130         | 60 yrs     | \$0.75               | \$88.75           | \$2.04           |
| Solar PV             | 7             | 33%             | -                   | \$4,274         | 20 yrs     | \$ -                 | \$16.70           | \$ -             |
| Concentrating Solar  | 150           | 31%             | -                   | \$5,493         | 20 yrs     | \$ -                 | \$26.04           | \$ -             |
| Solar Thermal        | 100           | 38%             | -                   | \$4,030         | 20 yrs     | \$ -                 | \$64.00           | \$ -             |
| Wind Onshore         | 100           | 35%             | -                   | \$2,322         | 20 yrs     | \$ -                 | \$28.07           | \$ -             |
| Wind Offshore        | 400           | 40%             | -                   | \$5,488         | 20 yrs     | \$ -                 | \$53.33           | \$ -             |
| Geothermal           | 50            | 79%             | 10,990              | \$4,141         | 20 yrs     | \$ -                 | \$84.27           | \$9.64           |
| Biomass Wood         | 40            | 76%             | 13,000              | \$3,411         | 20 yrs     | \$5.00               | \$100.50          | \$5.00           |
| Biomass Other        | 1             | 50%             | 17,500              | \$6,600         | 20 yrs     | \$1.00               | \$50.68           | \$16.64          |
| Biomass Gasification | 20            | 75%             | 12,350              | \$7,332         | 20 yrs     | \$3.00               | \$338.79          | \$16.64          |
| Hydro                | 500           | 75%             | -                   | \$3,076         | 20 yrs     | \$ -                 | \$13.44           | \$ -             |
| Landfill Gas         | 30            | 79%             | 14,179              | \$2,599         | 20 yrs     | \$4.50               | \$116.80          | \$0.01           |

# Generic Generating Resource Assumptions (2010\$)

## Operating characteristics for existing generating resources

| Technology                      | Heat Rate | Min up time | Min down time | Variable O&M | Fixed O&M | Start Cost |
|---------------------------------|-----------|-------------|---------------|--------------|-----------|------------|
|                                 | BTU/kWh   | HRs         | HRs           | \$/MWh       | \$/kW-yr  | \$         |
| Gas steam reheat                | 12,000    | 8           | 8             | 8.00         | 10.00     | 2,500      |
| gas steam non-reheat            | 13,000    | 8           | 8             | 5.00         | 10.00     | 2,500      |
| Supercritical Gas Steam         | 11,000    | 8           | 8             | 6.50         | 10.00     | 2,500      |
| Combustion Turbines (LM6000)    | 9,500     | 1           | 1             | 8.00         |           | 2,000      |
| Combustion Turbines ("E" class) | 11,500    | 1           | 1             | 4.00         |           | 1,000      |
| Combustion Turbines ("F" class) | 10,500    | 1           | 1             | 8.00         |           | 5,000      |
| Nuclear                         | 10,000    | 168         | 24            | 4.00         |           |            |
| Coal                            | 9,800     | 24          | 12            | 5.00         |           | 5,000      |
| Combined Cycle (1995 and later) | 7,200     | 6           | 4             | 2.65         |           | 15,000     |
| Combined Cycle (LM6000)         | 8,000     | 4           | 8             | 5.00         |           | 5,000      |
| Combined Cycle ("E" class)      | 8,500     | 4           | 4             | 3.00         |           | 3,000      |
| Biomass                         | 13,000    | 8           | 6             | 9.50         |           | 2,500      |

# Generic Generating Resource Assumptions (2010\$)

## Operating characteristics for new generating resources

| Technology                | Capacity | Heat Rate | Min Capacity | Min up time | Min down time | Variable O&M | Start Cost | Estimated CF |
|---------------------------|----------|-----------|--------------|-------------|---------------|--------------|------------|--------------|
|                           | MW       | BTU/kWh   | MW           | HRs         | HRs           | \$/MWh       | \$         | %            |
| Conventional CC (F type)  | 500      | 7,200     | 200          | 6           | 8             | 2.65         | 10,000     | 50%          |
| Advanced CC (H & G type)  | 400      | 6,700     | 250          | 6           | 8             | 2.90         | 15,000     | 50%          |
| Conventional CT (F type)  | 170      | 10,500    | 130          | 2           | 3             | 8.00         | 7,500      | 10%          |
| Advanced CT (LMS100)      | 100      | 9,200     | 70           | 2           | 3             | 13.00        | 10,000     | 10%          |
| Supercritical Coal        | 600      | 9,000     | 250          | 24          | 12            | 3.95         | 5,000      | 75%          |
| Supercritical Coal W/ CCS | 625      | 11,950    | 250          | 24          | 12            | 7.35         | 7,000      | 80%          |
| IGCC                      | 625      | 9,000     | 250          | 24          | 12            | 5.75         | 5,000      | 60%          |
| IGCC W/ CCS               | 539      | 10,700    | 250          | 24          | 12            | 7.00         | 7,000      | 60%          |
| Nuclear                   | 1,100    | 10,300    | 600          | 168         | 48            | 4.00         | -          | 90%          |
| On shore Wind             | 100      | -         | -            | -           | -             | -            | -          | 35%          |
| Off Shore Wind            | 100      | -         | -            | -           | -             | -            | -          | 40%          |
| Geothermal                | 40       | 11,000    | 20           | 8           | 8             | 10.00        | -          | 80%          |
| Biomass - wood            | 40       | 13,000    | 15           | 8           | 8             | 9.50         | 2,500      | 75%          |
| Biomass - other           | 1        | 17,500    | 3            | 8           | 8             | 15.00        | 1,000      | 50%          |
| Solar PV                  | 10       | -         | -            | -           | -             | -            | -          | 33%          |
| Solar Thermal             | 100      | -         | -            | -           | -             | -            | -          | 38%          |