Modeling Working Group Recommendations and Proposed Approach on Outstanding Issues

EIPC SSC Meeting

April 29, 2011

Today's Presentation

Decision Required

- SPP Wind Contribution to Reserve Requirement
- Off-Shore Wind
- Future 4 DG
- Small Modular Reactor
- High PHEV (information only)

Sensitivities

- Extra High Natural Gas
- Reduced friction and/or hurdle rates
- Low natural gas prices
- Extra-low wind/renewables capital costs

Information Only

- Transfer Capabilities

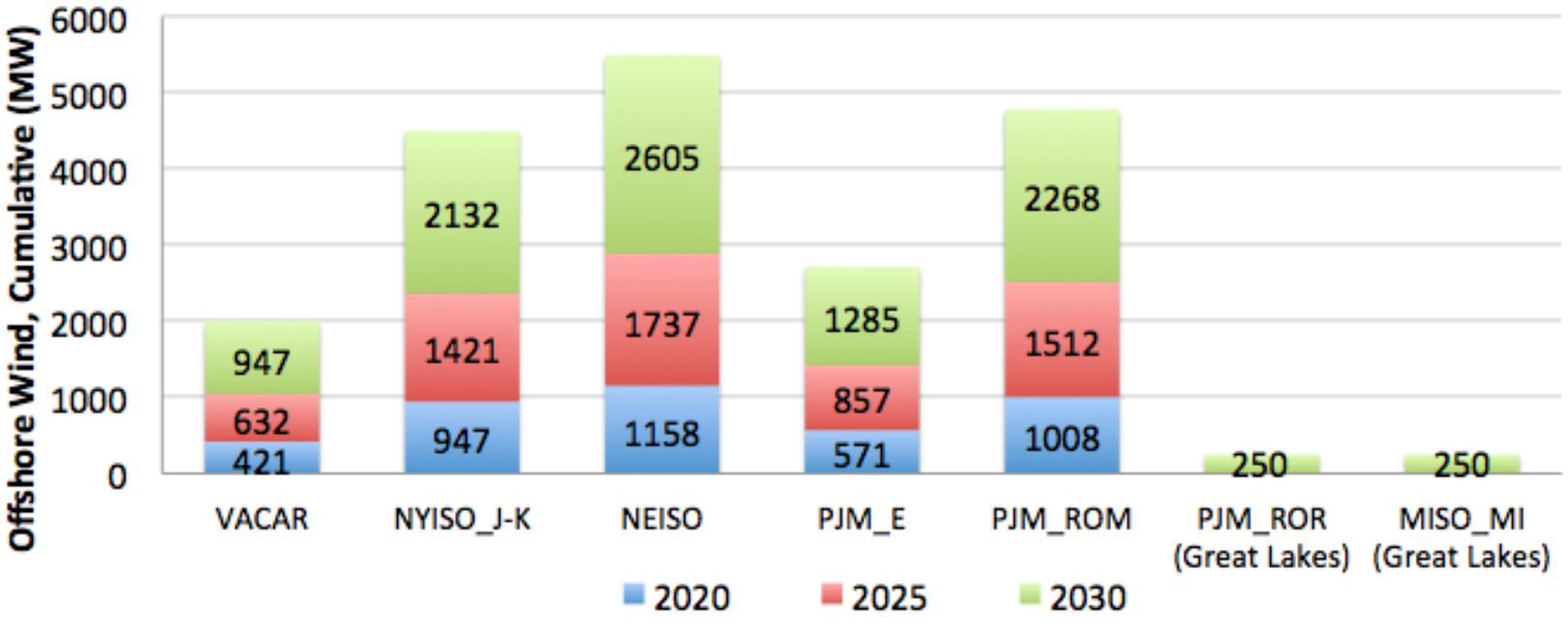
SPP Wind Reserve Contribution for Remaining Futures

- SPP recommends wind contribution to reserve requirements = 15% in all years and in all Futures other than the BAU for SPP region (including Nebraska)
- MWG adopted SPP's recommendation

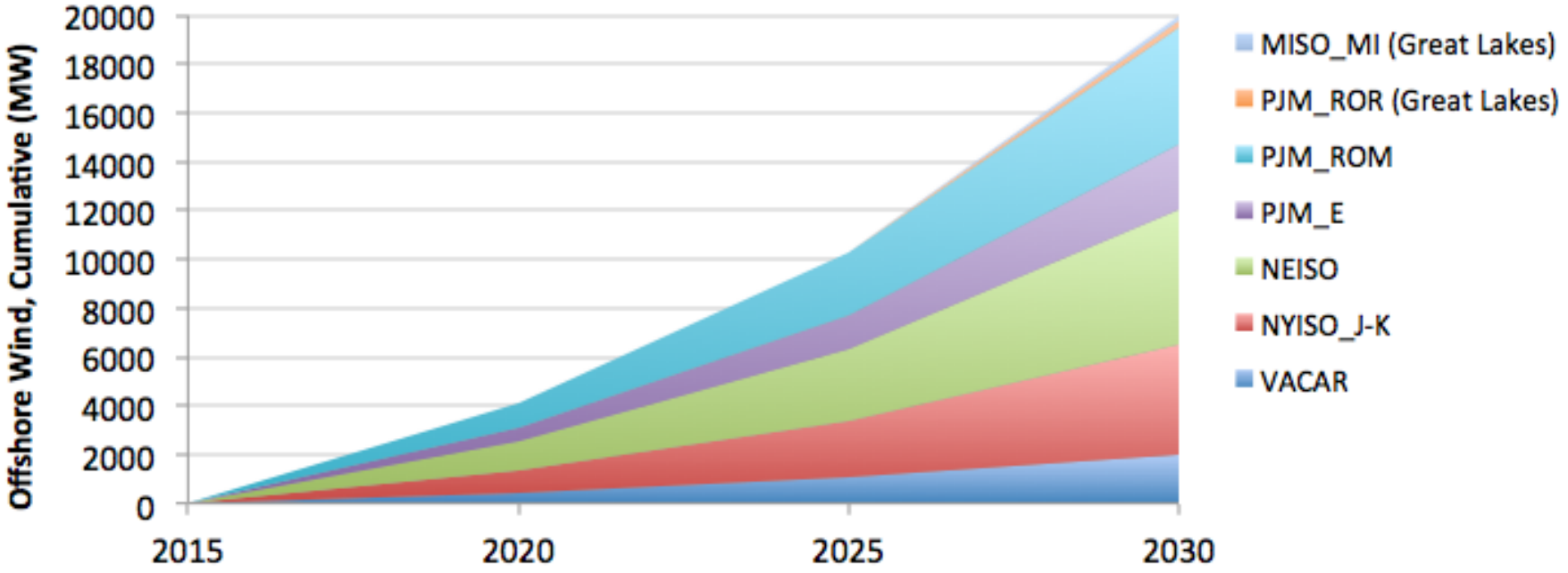
Off-Shore Wind Sensitivity/ies

- Total 20 GW
  - 19.5 GW in Atlantic
  - 0.5 GW in Great Lakes

Off-Shore Potential Sensitivity/ies



Off-Shore Wind Potential Sensitivity/ies

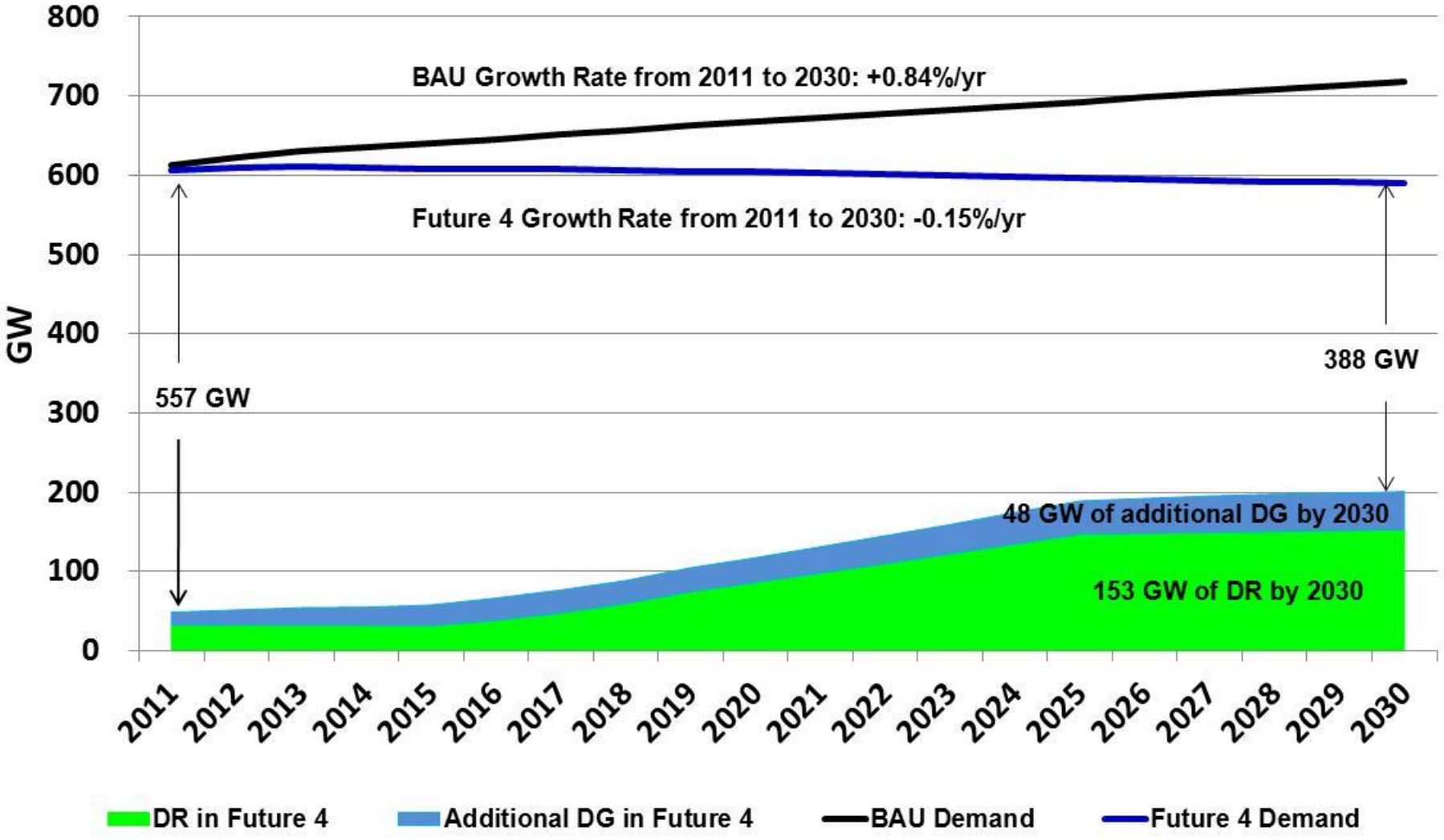


Future 4 Distributed Generation Assumed in Base Case

- Both BAU and Future 4 Demand Forecasts already include some level of behind the meter distributed generation (DG)
  - DG level in AEO 2011

- Aggressive level of renewable DG in Future 4
  - MWG consensus to include additional renewable DG at 2x AEO 2011 on top of what already embedded in the demand forecast
  - Total DG at 12% of peak demand

Future 4 Aggressive EE/DR/DG/Smart Grid



(EISPC) Future 7 Sensitivity - Small Modular Reactor

- Change size from 600 MW down to 120 MW
- Capital cost same as large scale nuclear
- Aggressive implementation start after 2020
  - Construction lead time 7 years
  - Learning rate at 15%

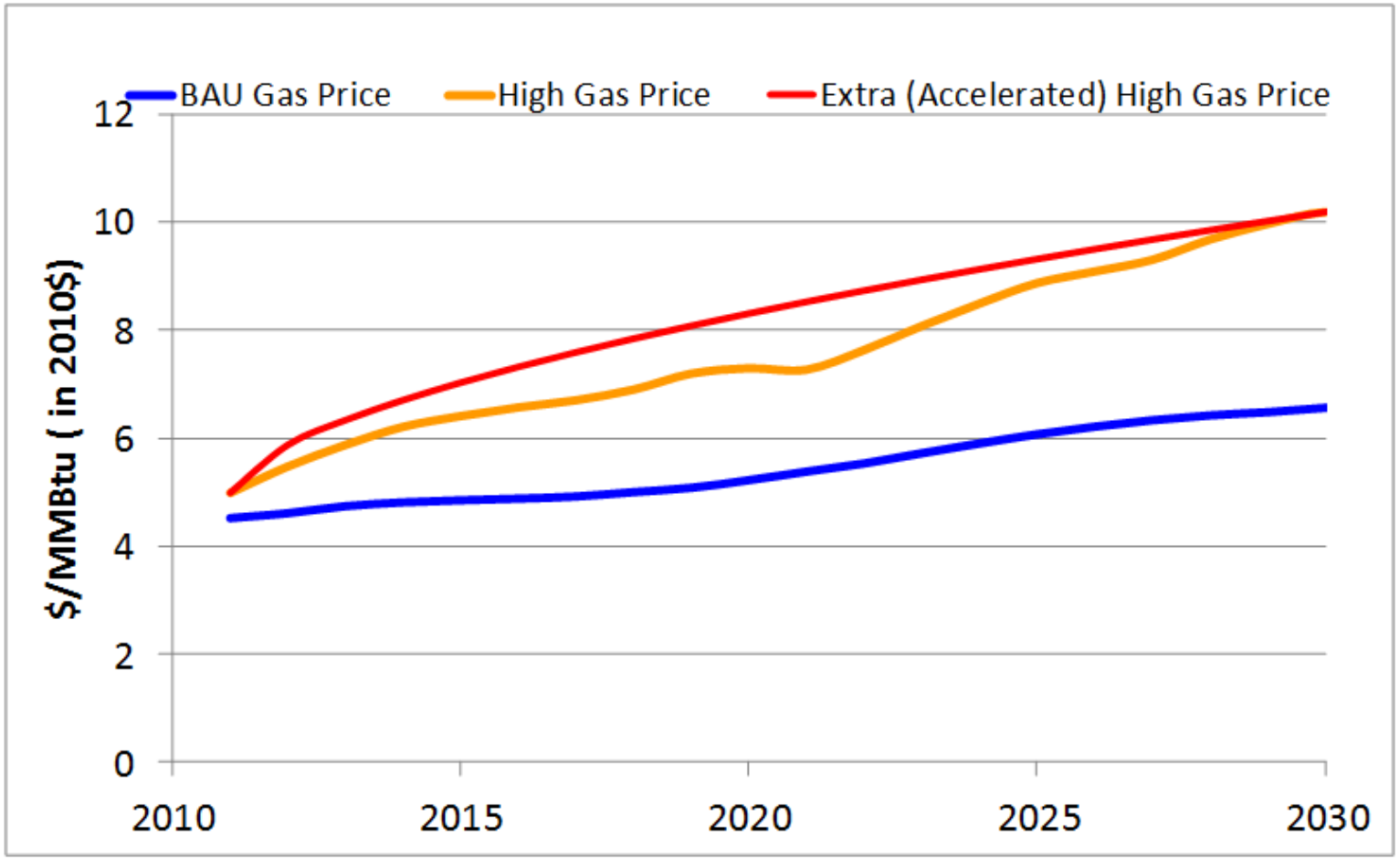
Remaining Sensitivities – Straw Proposal

- Add two additional accelerated gas price Sensitivities in BAU and F2 (impact = +2)
  - Alternative: Accelerated natural gas price to replace existing high gas price sensitivities (impact = 0)
- Friction and/or hurdle rates (impact = +1)
  - Reduced friction rates in Futures 2&3
  - Reduced hurdle rates in Futures 5&6
- Low Gas Sensitivity in Future 2 or 8 (impact = 0)
- Maintain existing forced off-shore wind Sensitivities in Futures 5&6 (impact = 0)
- Add one extra-low renewable capital cost Sensitivity to BAU; eliminate low renewable capital cost in Future 5 (impact = 0)

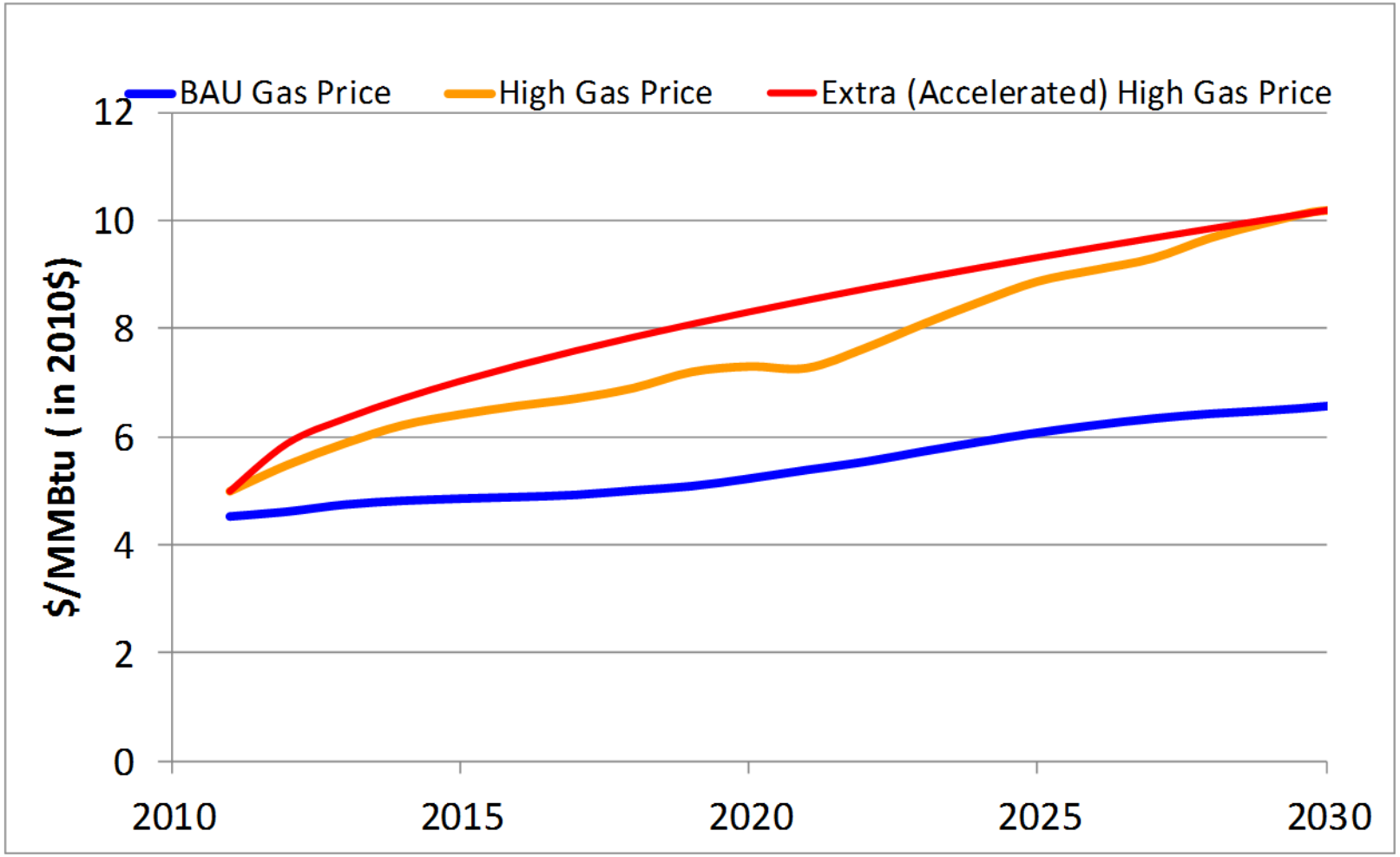
Considerations for an Extra High Natural Gas Price

- For non-gas resources to be economical, natural gas prices on the order of $7/MMBtu would be required
- New combined cycle units at BAU natural gas price appears to be competitive with existing coal, especially if environmental retrofit is required
- High natural price case does not reach $7/MMBtu until 2019
- BAU natural gas price never reaches $7/MMBtu over the planning period through 2030

Alternative Natural Gas Prices



Alternative Natural Gas Prices



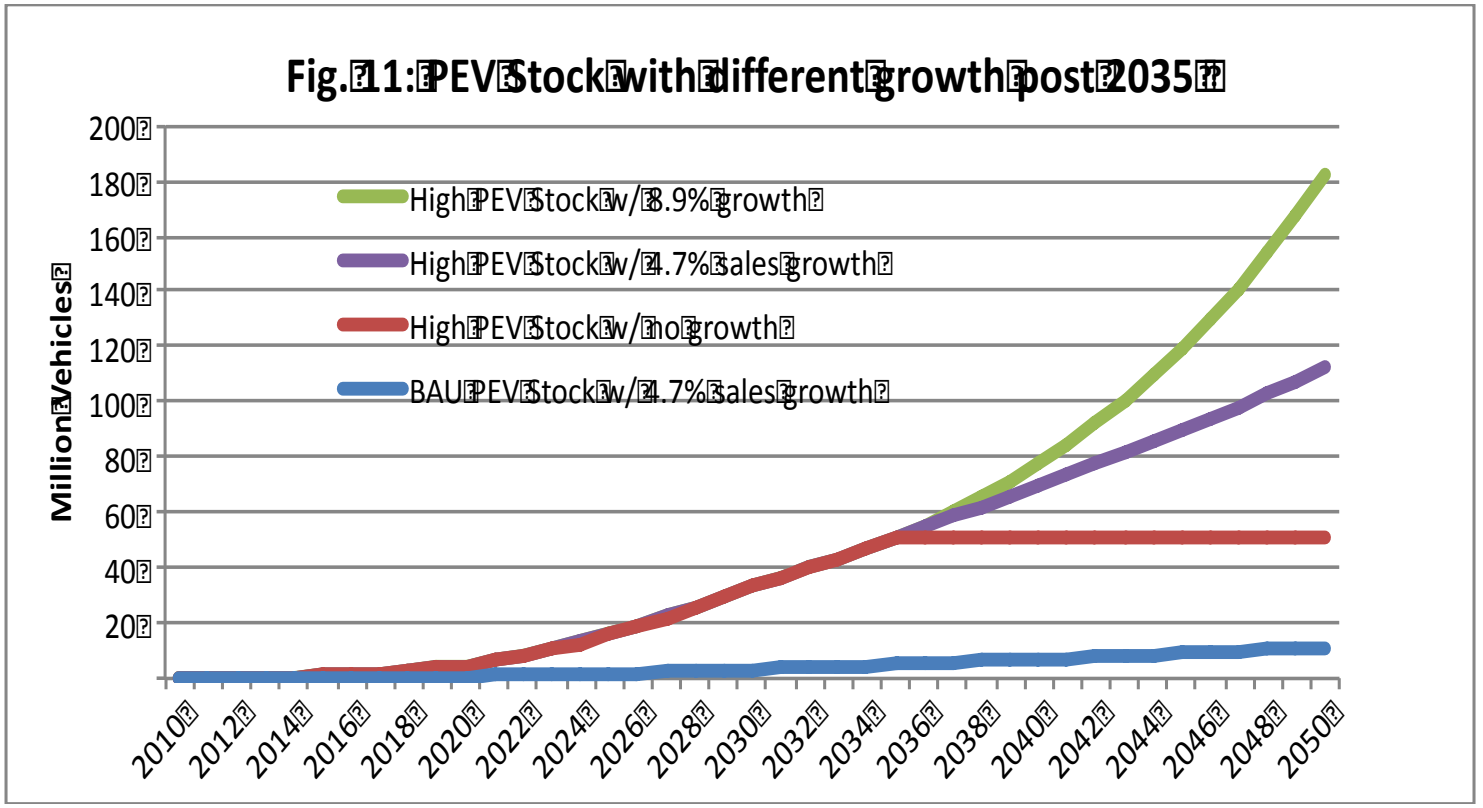
Extra High Natural Gas Price

- Option 1 (recommended)
  - Replace the high natural gas price case (already approved by SSC at February 7&8 meeting) with the extra high natural gas price curve
  - Avoids using additional sensitivities for the extra high natural gas case

- Option 2
  - Keep the extra high natural gas price curve as separate sensitivity from the high natural gas price case

High PHEV Sensitivities

- Applying 4.7% Sales Growth Line



Translating Sensitivity Results to Fixed Transfer Limits for Remaining Sensitivities

SSC has instructed the MWG to devise a method to translate the NEEM soft constraint results to fixed transfer limits for futures 2, 3, 5, 6, 7, and 8

- NEEM-TX Subteam is developing 1-2 methodologies for discussion/approval at May 18-19 SSC meeting
- If consensus cannot be reached around 1 methodology at in-person meeting, SSC will have to decide immediately after F2 transmission sensitivities results are released

Main Metrics Under Consideration

- Line Capacity Factor
  - Total flows across a transfer limit in comparison to potential flows on the baseline transfer limit (can go over 100% in soft constraint sensitivities)
  - Sensitivity flows can be used to develop a new transfer limit based on a Desired Line Capacity Factor
- Shadow Prices and Overload Charges
  - The marginal benefit of increasing the transfer capacity by 1 MW, all things being equal

Methodology Variations

- Only expand lines where overload charges are greater than $1/MWh
  - Eliminates low-value expansions
- Only expand lines that have a capacity factor greater than 85%
- Expand lines such that overload flow, all things being equal, would cause the expanded capacity to be used 40% of the time
- Expand lines such that total flow, all things being equal, would cause the total expanded line to be used 70% of the time
- Expand lines based on a desired capacity factor that is inversely proportional to the overload charges

Methodology Caveats 1

- **All things will not be equal**
  - Flows over expanded hardened transfer limits in remaining sensitivities will not be identical to those under soft constraint sensitivities
  - Expanded transfer limit line capacity factors will be different than desired capacity factors used to expand the lines
    - Expanded transfer limits will not have overload charges so flows should increase
    - Many transfer limits will revert to baseline levels, increasing potential demand for flows over expanded transfer limits

Methodology Caveats 2

- Shadow Prices should not be used as clear proxies for transmission costs/benefits
  - Shadow prices only directly reflect marginal costs
  - Different transfer limit expansions will have greatly different costs
  - Shadow prices can help identify more cost-beneficial transfer limit expansions, all things being equal (see above)

Potential Methodology

- Use data from 2020-2035
- Some threshold criteria based on shadow prices/overload charges
- Increased transfer capacities based on desired line capacity factor
  - Possibly related to overload charges
  - Possibly based on total flows, overload flows or some combination of the two
- Potential differences on magnitude of price/charge threshold and magnitude of desired line capacity factor