



MISO Futures Development

February Workshop

February 13, 2020

Updated 2/24/20: Slides 7 & 8

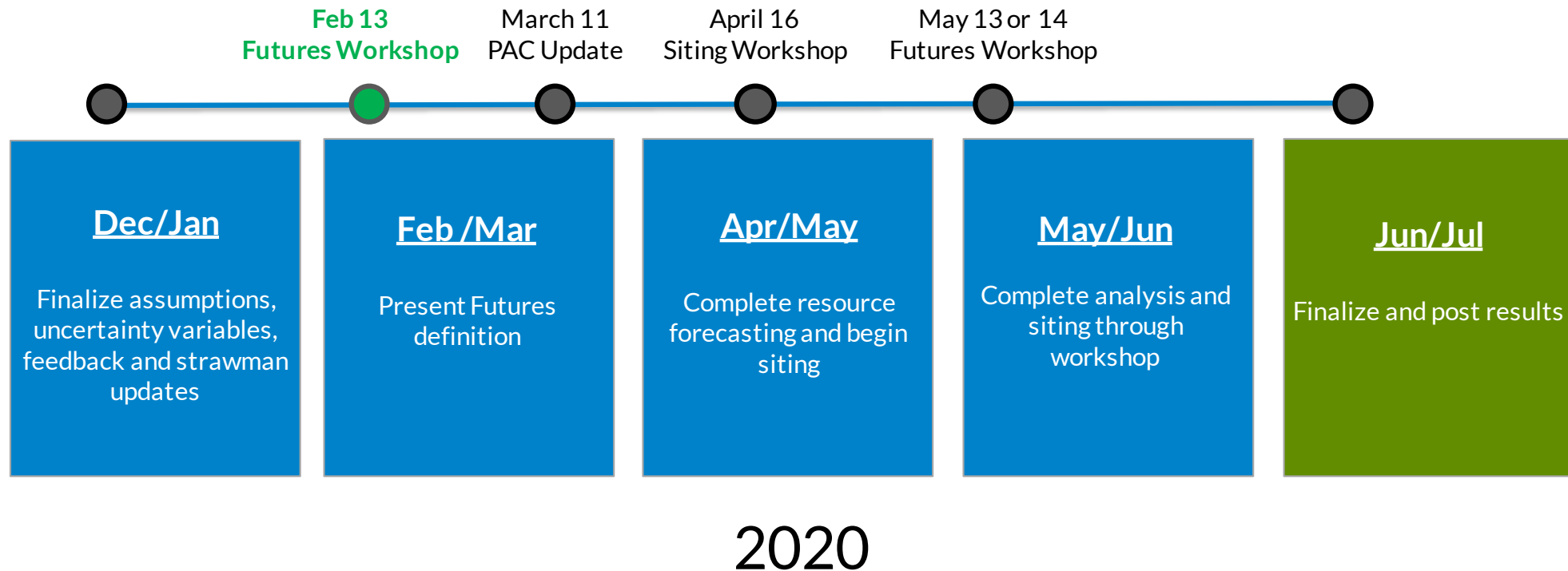
Agenda

MTEP Futures Workshop #5 *(all times CT)*



- | | |
|-----------------------------------|--------------|
| 1. Welcome & Introductions | 9:00 – 9:15 |
| 2. Review/Discuss Feedback | 9:15 – 9:30 |
| 3. Lunch | 11:30– 12:00 |
| 4. Updated Strawman & Assumptions | 12:00 – 2:45 |
| 5. Review Next Steps | 2:45 – 3:00 |
| 6. Adjourn | 3:00 |

Futures Development Schedule



Feedback Summary - Themes

- Overall nature of the updates
- Percentage of the IRPs met
- Coal Retirement Age
- Carbon Reduction
- Electrification



Initial Assumptions (October 17, 2019)

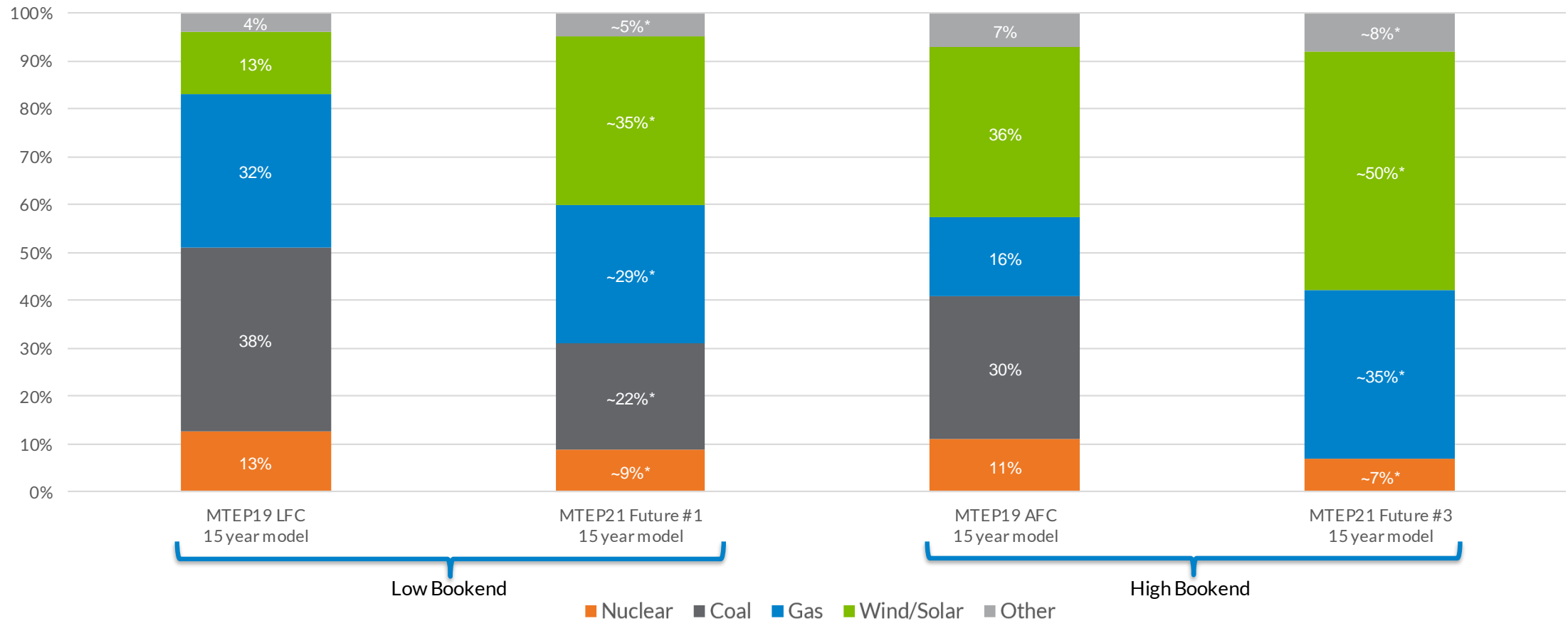
	Future I	Future II	Future III
Demand and Energy Growth	Low	Medium	High
Coal Retirement Age	46 years	36 years	30 years
IRP % met	100%	100%	100%
Carbon Reduction	X	50%	80%
Renewable Penetration	X	X	50%
DER Growth	X	yr. by yr. +30%	30% of energy served by DERs
Natural Gas Prices	Low	Medium	High
Electrification	X	40% energy growth = 52% technical potential	70% energy growth = 100% technical potential
EV Charging	Only uncontrolled charging	All scenarios are offered at different year start dates	All scenarios are offered at different year start dates

Draft MTEP21 Futures Overview

I	II	III
<p>The footprint develops with a slight delay compared to utility announcements/plans, along with state mandates, goals, or preferences.</p>	<p>Changing federal and state policies support carbon emissions reduction of 60% or more. EV adoption increases and electrification begins, driving 30% growth in energy demand.</p>	<p>Changing federal and state policies support carbon emissions reduction of 80% or more. Accelerated EV adoption and electrification occurs, driving 60% growth in energy demand.</p>

Proposed MTEP21 Futures show significant evolution from the MTEP19

Low & High Bookends of MTEP19 vs Draft MTEP21 Futures



Updated Assumptions (1 of 2)

Variables / Futures	Future I	Future II	Future III
Percent of Goals Met	≥ 85% goals met ≥ 100% IRPs met	≥ 100% goals met ≥ 100% IRPs met	≥ 100% goals met ≥ 100% IRPs met
Carbon Emissions Reduction* (2005 baseline)	≥ 40% (currently at 22%)**	≥ 60%	≥ 80%
Retirements–Coal Retirements–Natural Gas-CC Retirements–Natural Gas-Other	46 years 50 years 46 years	36 years 45 years 36 years	30 years 35 years 30 years
Wind & Solar Penetration	No minimum	No minimum	≥ 50%
EV Adoption & Charging Technology	Low-Base EV growth Uncontrolled charging	Base-High EV growth Uncontrolled 2020-2035 & V2G 2035 and beyond	Extra-High EV growth Uncontrolled 2020-2030 & V2G 2030 and beyond
Electrification (gas to electric appliances / heating / cooling)	None	39% of technical potential realized representing a 30% energy growth	77% of technical potential realized representing a 60% energy growth
Demand & Energy Growth	Future-dependent (based on “Merged” ILF forecast); Awaiting Future-specific forecast from AEG	Future-dependent (based on “Merged” ILF forecast); Awaiting Future-specific forecast from AEG	Future-dependent (based on “Merged” ILF forecast); Awaiting Future-specific forecast from AEG

Updated Assumptions (2 of 2)

Variables / Futures	Future I	Future II	Future III
DER Technical Potential by 2040 (GW)^	DR: 5.2 EE: 13.3 DG: 14.7	DR: 5.9 EE: 14.5 DG: 14.7	DR: 5.9 EE: 14.5 DG: 21.8
Natural Gas Prices	Base starting price determined by GPCM; Future-specific price input to PROMOD	Base starting price determined by GPCM; Future-specific price input to PROMOD	Base starting price determined by GPCM; Future-specific price input to PROMOD
External Modeling	Pick “more aligned” SPP Future and single PJM	Apply our assumptions to external areas (take their sites though)	Apply our assumptions to external areas (take their sites though)

Updated Futures Strawman

- Walk through the Futures Strawman Proposal
- Finalized Decisions:
 - Three equally weighted futures
 - Renewable penetration levels
 - Carbon reduction targets