



Futures Resource Expansion & Siting Review for MTEP21

Futures & Siting Workshop

July 13, 2020

Executive Summary



Purpose:

- Review draft resource expansion results and siting to be used in MTEP21
- Discuss and request feedback from stakeholders

Key Takeaways:

- Over 257 GW of new resources built in F3, 159 GW in F2, & 131 GW in F1
- Primarily consisting of solar, wind, & gas
- Begin to see solar hybrid & CCCC in F2/3

Recap of new MISO Futures

Future I

- The footprint develops in line with 100% of utility IRPs and 85% of utility announcements, state mandates, goals, or preferences.
- Emissions decline as an outcome of utility plans.
- Load growth consistent with current trends.

Future II

- Companies/states meet their goals, mandates and announcements.
- Changing federal and state policies support footprint-wide carbon emissions reduction of 60% by 2040.
- Energy increases 30% footprint-wide by 2040 driven by electrification.

Future III

- Changing federal and state policies support footprint-wide carbon emissions reduction of 80% by 2040.
- Increased electrification drives a footprint-wide 50% increase in energy by 2040.

Recap of new MISO Futures' key assumptions

Variables / Futures	Future I	Future II	Future III
EGEAS Ready Gross Load[^] Energy Demand	Low-Base EV growth 0.63% CAGR growth rate 0.59% CAGR growth rate	30% energy growth 1.23% CAGR growth rate 1.09% CAGR growth rate	50% energy growth 1.91% CAGR growth rate 1.94% CAGR growth rate
Potential Load Modifiers^{^^} (Technical Potential by 2040) DR EE DG	Technical Potential Offered 5.2 GW 13.3 GW 14.7 GW	Technical Potential Offered 5.9 GW 14.5 GW 14.7 GW	Technical Potential Offered 5.9 GW 14.5 GW 21.8 GW
Carbon Reduction* (2005 baseline) MISO Footprint currently at 22%**	40%	60%	80%
Min. Wind & Solar Penetration	No minimum	No minimum	50%
Utility Announced Plans	85% goals met 100% IRPs met	100% goals met 100% IRPs met	100% goals met 100% IRPs met
Retirement Age-Based Criteria Coal Natural Gas-CC Natural Gas-Other	46 years 50 years 46 years	36 years 45 years 36 years	30 years 35 years 30 years

* Entire footprint in aggregate

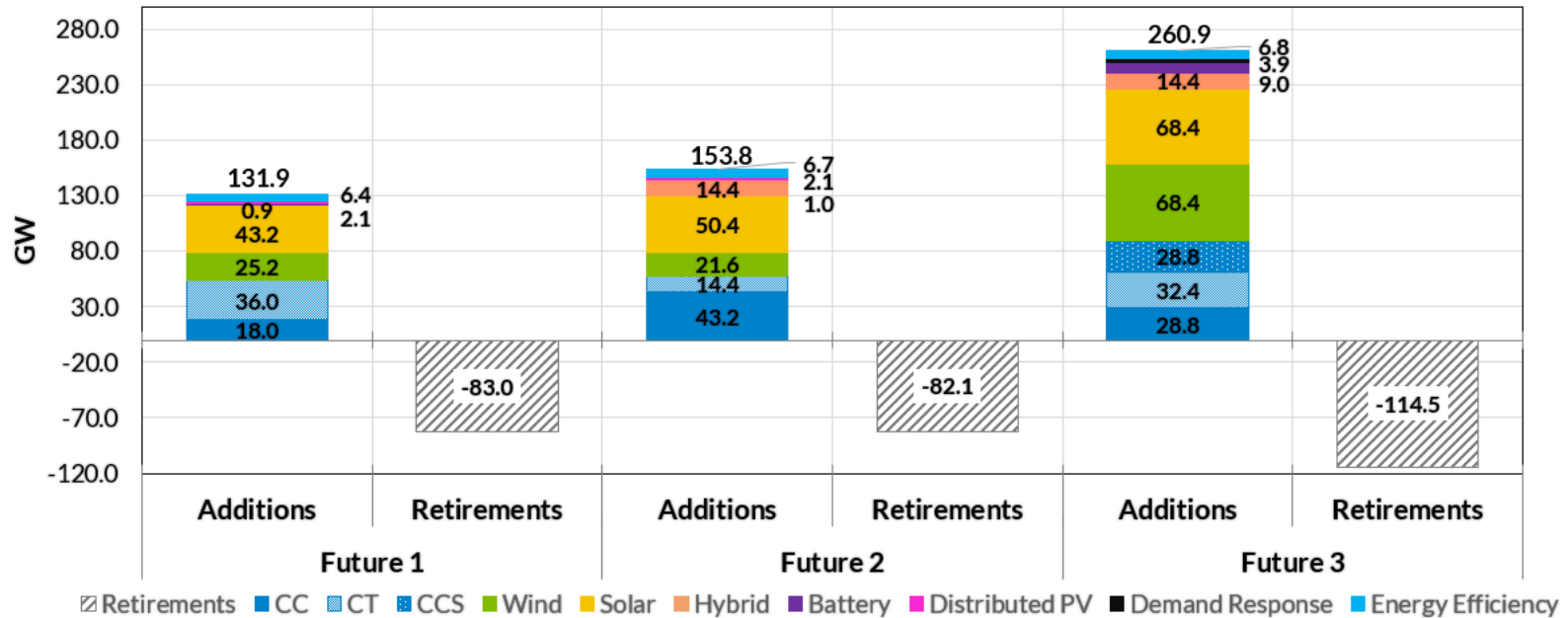
** 2005-2017; MISO calculation from EIA Form 860 data

[^] Compound annual growth rate (CAGR); does not include impact from DERs, DSM, or Wind/Solar

^{^^} Distributed Energy Resources (DER); Demand Response (DR); Energy Efficiency (EE); Distributed Generation (DG); Capacity technical potential offered into EGEAS as resources; final amounts selected to be determined by EGEAS simulations.

Capacity Additions by Future

(2020 through 2039)

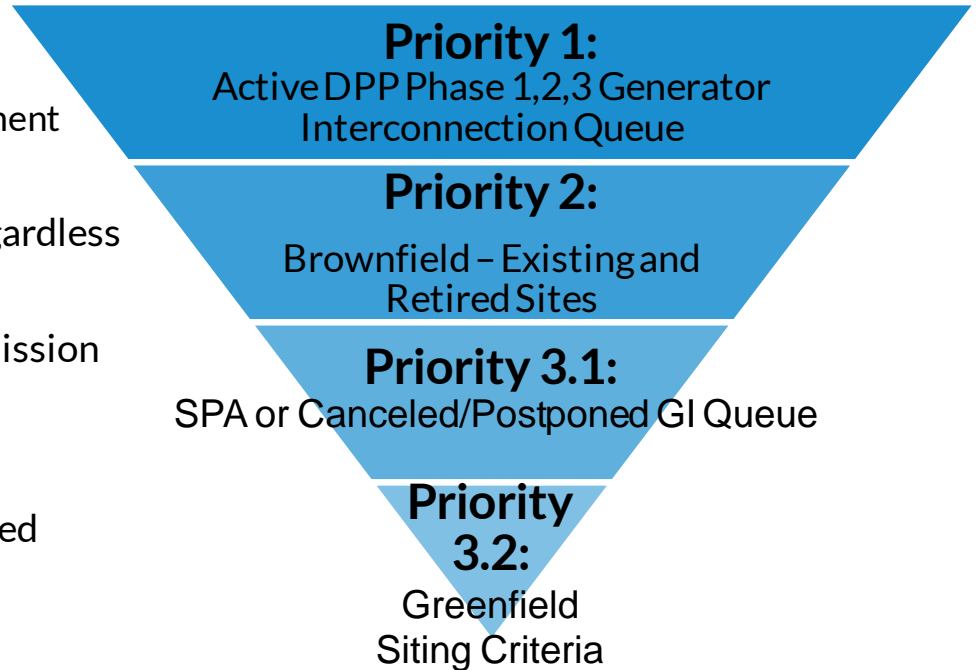


Siting Update

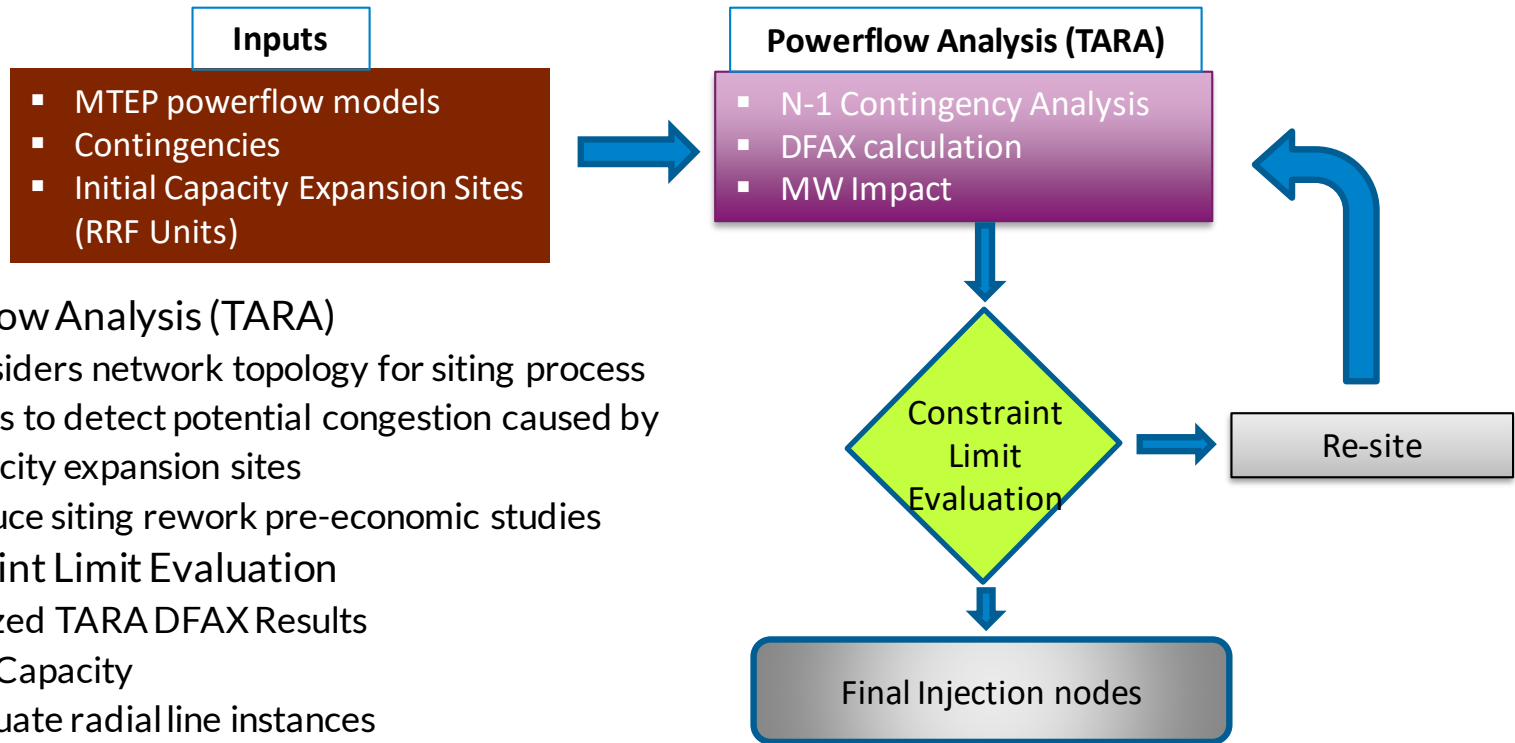
Thermal Siting Methodology Update

- **Priority 2 Site Updates**

- Future-specific sites based off retirement criteria
- All thermal retired sites included, regardless of the 230kV MTEP19 requirement
- Site priority ranked by earliest commission date with no cutoff
- Includes sites 50 MW or greater
- Site capacity capped at existing, retired generator capacity



Pre-Site Screening Enhancements



- Powerflow Analysis (TARA)
 - Considers network topology for siting process
 - Helps to detect potential congestion caused by capacity expansion sites
 - Reduce siting rework pre-economic studies
- Constraint Limit Evaluation
 - Utilized TARADFAX Results
 - N-1 Capacity
 - Evaluate radial line instances
 - Surrounding Generation Capacity

Storage Siting Methodology Update

- MTEP19 Methodology
 - Site energy storage at top load bus per PowerBase area
 - Distribute capacity on a load ratio share
- MTEP19 Methodology Issues
 - MTEP21 Future storage capacity amounts will exhaust top load bus potential distribution capacity (N-1 Capacity)
- MTEP21 Proposed Storage Siting Methodology
 - Pick top load bus for each PowerBase area
 - Determine nearest bus with highest transmission distribution capacity for each top load bus
 - Distribute capacity to these sites on a load ratio share

Solar PV + Storage Siting Methodology

- Proposed hybrid siting methodology
 - Use VCE utility-scale solar PV sites
 - Prioritize siting of hybrid renewables, beginning with top-tier sites
 - Utility-scale solar (non-hybrid) will use remaining VCE sites
 - Hybrid and non-hybrid site overlap can occur, pending available site capacity and resource expansion capacity needed

Distributed Solar Siting Methodology Update

- MTEP19 Methodology
 - Site distributed solar PV (DPV) storage in top 25 most suitable counties per LRZ for distributed solar adoption based on 2018 county-level data
 - Site DPV at the top load buses per county, at a minimum of two buses and a maximum of 20 buses
- MTEP21 Proposed DPV Siting Methodology
 - Utilize the top conforming load buses in each PowerBase area, up to a maximum of 20 buses
 - Distribute capacity to these sites on a load ratio share

Demand-Side Siting Methodology

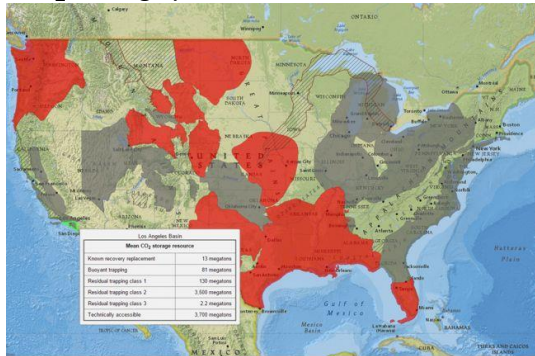
- MTEP21 Methodology (unchanged from MTEP19)
 - Methodology used to site demand-side management (DSM) category programs including energy efficiency and demand response
 - Utilize the top non-conforming load buses in each PowerBase area, up to a maximum of 10 buses
 - Distribute capacity to these sites on a load ratio share

Combined Cycle with Carbon Capture Sequestration offered after 2030 to meet CO₂ Requirements

Proposed Siting Methodology:

- Pull previous sites from the queue for additional sites
- Locate CC sites that are in the red area of the map below for potential CCS sites
- Site after regular CC and CT units
- Feedback requested

CO₂ Storage potential in the United States



Unit Costs	CC	CT	CCS
Capital Cost (\$)	1,076	983	2,242
Fixed O&M (\$/kW - yr)	13.095	11.6	34
Variable O&M (\$/MWh)	2.2	4.58	7
Heat Rate (MMBtu/MWh)	6.4005	9.5145	7.525
CO ₂ (lbs/MMBtu)	117	117	11.7
NOX (lbs/MMBtu)	0.02	0.15	0.02
SO ₂ (lbs/MMBtu)	0.0033	0.0098	0.0033

CCS units have higher overall cost, but produce only 10% of the CO₂ of a CC or CT unit

Going Forward

Feedback Request:

- Please provide feedback on the draft MTEP21 expansion, potential sites, and siting criteria ***by July 24th*** via the [MISO Feedback portal](#), and send any questions or attachments to mtepfutures@misoenergy.org
 - Unit Siting Bus Locations – Please inform if site is not feasible (including why) and provide an alternate siting location
 - CCS and Battery siting – Please provide feedback if there are specific buses that these resources should be sited at in your respective area/territory

Next Steps:

- Additional information as well as finalized expansion results of MTEP21 Futures will be provided in August

Contact Information



MTEP Futures Team:

MTEPFutures@misoenergy.org



Questions?