Clean Power Plan Modeling Guide

	MISO	AWEA	EPRI	M.J. Bradley
What is the name of the model?	PLEXOS, by Energy Exemplar	CPP Cost Optimization and Risk Evaluation (CORE)	US-REGEN	ICF's Integrated Planning Model (IPM)
General description of the model.	Production cost model: -Produces optimal, chronological, hourly dispatch considering generation, detailed transmission, and emissions constraints -Models energy and ancillary service markets for each market footprint -Includes the Bulk Electric System for the majority of the Eastern Interconnect	Quantifies emissions reductions needed and identifies lowest-cost mix of energy to meet CPP for each state using user-specified inputs and ranges of uncertainty	Inter-temporal capacity expansion model of the U.S. electric sector.	IPM is an electric system model that solves for the least-cost means of meeting electric energy and capacity requirements while complying with specified constraints, including air pollution regulations, transmission constraints, and plant-specific operational constraints.
Other uses in addition to CPP modeling.	Minnesota Renewable Integration and Transmission Study (2014), Manitoba Hydro Wind Synergy Study (2013)	Quantifies fuel price risk	Extensively used for analysis of climate and environmental regulations as part of EPRI's research programs.	IPM has been used to evaluate numerous environmental regulations.
Constraints or limitations	PLEXOS is not being used to optimize capacity or transmission expansion. It uses DC analysis and primarily considers thermal constraints on transmission.	Not a detailed capacity expansion model, so reserve margins and timing of investment must be assessed separately	Does not consider power flow constraints within a state, nor include unit commitment constraints.	Models, like IPM, are designed to evaluate how variations in key assumptions can lead to different outcomes. The projections are not predictions of the future but indicators of what might happen, given the specified assumptions and methodologies.
What costs are included in the model?	**Inputs:** fuel costs, fixed operating & maintenance (O&M) costs, variable O&M costs (capital costs and transmission costs are not included) **Outputs:** production costs, Locational Marginal Prices, shadow prices on constraints (representative of allowance/ERC prices in the CPP study)	All generation costs are included, transmission costs are not.	Capital, operating, fuel, transmission, regulatory costs	All system costs are incorporated into the model: fuel, O&M, capital, and energy efficiency program costs. Energy efficiency participant costs and T&D charges are reflected in rates and bills.
What are the objectives for your modeling runs?	**Overall study goals:** **-**to inform policymakers as they formulate compliance strategies -to enable the reliable, efficient implementation of CPP-related policy decisions made by MISO member-states and asset-owners **Near-term modeling goals:** -understand options for compliance pathways: rate vs. mass, state vs. regional, trading options, compliance sensitivities, relative compliance costs	Find the lowest-cost generation mix to meet the CPP under user-specified scenarios.	Meet load in every state across every hour of the year through 2050, at minimum cost to the U.S. as a whole.	Our objectives were to understand the potential costs and implications to the system if the different CPP regulatory options and how key assumptions might influence those outcomes.

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What timeframe does the model cover?	2022, 2025, 2030	2012-2030	2015-2050	2016-2040
How are your CPP modeling runs funded?	General MISO budget	Tool developed by AWEA. Model is free and open source.	Funded by EPRI members and utilities through EPRI Program 103 and specific state CPP supplemental projects.	A combination of NGO and industry funding
Describe next steps. *e.g. will you continue to model during the stay?*	Mid-term modeling includes: (1) cost analysis of potential coal retirement levels driven by scenarios representing potential industry trends (2) update of renewables siting process informed by VCE study. The mid-term modeling will inform the MISO's Transmission Expansion Plan futures development process.	Yes. Plan to continue updating the model and adding new features.	EPRI has several ongoing and new CPP state analyses which will continue, as will work in EPRI Program 103, albeit at a less frenetic pace.	Yes, we are planning to model additional cases beyond those presented at the meeting