

PREPARED BY GDS ASSOCIATES, INC.



Ameren

MISSOURI

AMEREN MISSOURI

Dynamically Optimized Portfolio Extension

MEMORANDUM

September 01, 2020



Introduction

Ameren Missouri requested GDS Associates to assist in the development of a "Dynamically Optimized Portfolio Extension" or "DOPE" portfolio of demand side measures ("DSM"). GDS served as the lead author of the 2020 DSM Market Potential Study ("MPS"). The 2020 MPS includes an assessment of Realistic Achievable Potential ("RAP") and Maximum Achievable Potential ("MAP") portfolios, which are included in the IRP and serve as a basis for the DOPE portfolio analysis. The DOPE portfolio is required as part of the DSM plan and will be included as a sensitivity analysis in the 2020 Integrated Resource Plan ("IRP"). Public Service Commission ("PSC") Staff requested the analysis of a DOPE portfolio as part of the 2017 IRP stipulation and agreement.

Initial DOPE Portfolio Considerations

The primary purpose of a DOPE portfolio is to investigate the overall impacts, from a resource planning standpoint, of an alternative to RAP and MAP demand side portfolios. Specifically, while DSM portfolios have been found to provide numerous benefits (including avoided cost energy and demand savings; increased health, comfort, safety; employment; and reduced emissions), the focus of a DOPE portfolio is to more narrowly time DSM investments with future supply side resource needs. That is, a DOPE portfolio is intended to defer future resource needs on a just in time basis so that the IRP can examine whether a deferred investment in energy efficiency and/or demand response is preferred over continued program operations during a period of excess capacity, when considering net benefits on a risk adjusted basis.

As a starting point, there were several foundation assumptions considered in the development of the DOPE Portfolio parameters, including:

- DOPE portfolios should be based on cost-effective measures, as measured by the Total Resource Cost ("TRC") test
- DOPE portfolios should consider either RAP and/or MAP estimates
- DOPE portfolios should include demand response programs.
- DOPE portfolios should continue to rely on market adoption curves from the potential study, adjusted as appropriate for the relevant start dates
- DOPE portfolios will include the "Scenario #1" Income-Qualified (IQ) portfolio (from the MPS) as a base assumption without any optimization adjustments

GDS and Ameren Missouri coordinated to initially define two scenario options for DOPE portfolio development. The first scenario was established to examine the impact of delaying the MPS' projections of MAP or RAP EE/DR achievable potential out into the future. In this first DOPE Portfolio Scenario, also referred to as "Program-Level DOPE", the only adjustment to the MAP or RAP estimates of potential entail delaying the start year from 2022 to a future year, in order to adequately meet the future resource need on a "just in time" basis.

Alternatively, a second scenario, referred to as a DOPE Portfolio Scenario 2, also referred to as "Measure-Level DOPE", was established that could take a more targeted look at meeting future resource needs. Through the development of a supply curve, GDS and Ameren Missouri could prioritize each individual EE and/or DR measure based on a specified metric, thereby creating a loading order to determine which measures should be included in the DOPE Portfolio to meet the future resource need, and which measures can be excluded for the future portfolio.

Following a series of stakeholder meetings to discuss the development of the DOPE Portfolio Scenarios and initial results, parameters for each scenario were finalized.

Capacity Shortfall Targets

Based on guidance from Ameren Missouri, GDS targeted a capacity shortfall of 1,000 MW in the 2034 to 2036-time frame. The target was developed as part of the resource planning process, and is designed to approximate the capacity need under a wide range of resource plans.

Stakeholder Involvement

GDS and Ameren Missouri conducted two meetings with stakeholders during the May-June 2020 timeframe. The first meeting served to introduce the initial DOPE portfolio constructs to stakeholders. Based on feedback during this meeting, GDS was able to refine the scope of the DOPE Portfolio and focus each scenario on meeting the capacity shortfall during the 2034-2036 window. Stakeholders also requested that the development of each DOPE Portfolio scenario consider the Utility Cost Test (UCT) benefit-cost ratio, in addition to the originally proposed metric for analysis of levelized cost per lifetime kW-saved.

The second meeting discussed the initial results based on several different DOPE Portfolio scenario options. For DOPE Scenario 1 (Program-Level), GDS presented six different options that delayed various combinations of the MPS savings estimates, based on sector (Residential/Business), resource type (EE/DR), and savings level (MAP/RAP). For example, GDS compared Scenario 1 options that prioritized DR, delaying EE into the future until necessary to meet the future resource need versus prioritizing business sector savings (using both EE and DR), delaying residential sector savings (EE or DR) into the future. Additional options looked at additional mixes of MAP/RAP savings and deferred years across sector and resource type, all targeting meeting the 2034-2036 resource need on a “just in time” basis. For each DOPE Scenario 1 option, GDS compared the overall levelized cost per lifetime MW-saved, the overall UCT score, the NPV net benefits, NPV lifetime kW saved, and overall contribution to meeting future resource needs beyond 2036.

Similarly, for DOPE Scenario 2 (Measure-Level), GDS presented initial options and results that prioritized (via a supply curve) individual measures based on either the levelized cost per lifetime kW or the UCT score. While both MAP and RAP savings were included in the analysis, the lower incentives associated with RAP analysis typically produced lower metrics for both the cost of capacity and UCT score, leading to the prioritized selection of the RAP measures over their MAP counterparts in most instances.

Based on the second meeting, and corresponding input from stakeholders, GDS and Ameren Missouri determined that the first DOPE scenario would include DR and EE options for both sectors. First, demand response RAP savings for both residential and business sectors would be delayed, thus dampening any plateau in DR savings prior to the targeted capacity shortfall in 2034-2036. Any remaining capacity needs during the 2034-2036 window would be met with EE programs (again, delayed until the last possible year). Following stakeholder feedback, GDS determined that DOPE Portfolio Scenario 2 would be selected on the UCT-based supply curve instead of the Cost of Capacity-based curve. Last, the delayed DR modeling noted for DOPE Portfolio Scenario 1 was also carried through into Scenario 2.

Final DOPE Portfolio Parameters and Results

The final DOPE Scenario 1 and DOPE Scenario 2 parameters and results are discussed below.

DOPE Portfolio #1: Program-level

As noted above, the first step in the assessment of the DOPE Portfolio: Program-Level Scenario was to include the base level of income-qualified potential assumed in the MPS. GDS did not delay or change the annual projections of income-qualified potential from the levels assumed in the MPS.

The second step was to select the appropriate years to delay residential and business sector DR investments consistent with the feedback from stakeholders and remove any plateau in DR capacity prior to the 2034-2036 years of need. As a result of this, the projection of Business RAP DR was delayed from a start year of 2022 until 2026. Similarly, projections of Residential RAP DR were shifted from 2022 until 2029.¹

Once the DR RAP potential estimates were included in the scenario, the third and final step was to fill any remaining 2034-2036 capacity shortfall with business and residential EE savings. Relying on RAP projections (in lieu of MAP projections) due to their preferred UCT ratios, both business and residential EE RAP savings could be delayed from 2022 until 2028 and still meet the target capacity shortfall.²

Table 1, below, shows a comparison of the 2020 MPS' estimates of RAP and the DOPE Portfolio Scenario 1 on several metrics. Although the DOPE Portfolio has a slightly higher levelized cost per lifetime MW saved and UCT ratio compared to the RAP estimate, the DOPE Portfolio Scenario 1 more closely aligns with the identified capacity need in 2036 (1,014 MW³), and at a lower total NPV cost.

TABLE 1: COMPARISON OF 2020 MPS RAP VS DOPE PORTFOLIO SCENARIO 1

	Levelized \$ per Lifetime MW Saved (\$2022)	UCT Ratio	NPV Costs (\$2022, in millions)	Coincident Peak Reduction MW (at meter) in 2036
RAP	\$104,452	2.5	\$1,442	1,608
DOPE Portfolio – Scenario 1	\$113,760	2.3	\$896 ⁴	1,140

¹ The initial 2022 RAP estimates for EE/DR were calibrated to recent historical levels. Recognizing that it would be difficult for Ameren to achieve savings at current levels after several years of no assumed program activity, GDS added two-years of program ramp-up activity. For example, the original projections of Residential DR were shifted from 2022-2040 to 2031-2049, GDS then included ramp-up program activity in 2029 and 2030 at 1/3 and 2/3 the 2031 level, respectively.

² As with DR, following the initial shift in RAP savings (to 2030), GDS assumed two new program activity ramp-up years to achieve recent historical levels creating a modified start in 2028. Cumulative impacts on savings, benefits, and costs of these additional ramp-up years were included in the overall assessment of each scenario. No other changes to projections of RAP potential were made in DOPE Scenario 1.

³ After adjusting for line losses (7.42%) and the planning reserve margin (18.3%) in 2036.

⁴ NPV costs in Table 1 are over the same timeframe (2022-2040) as the RAP scenario. If delayed programs are assumed to continue to operate for the same 19-year window, program costs from 2022-2048 would have an NPV of \$1,116 million.

DOPE Portfolio #2: Program-level

For the final DOPE Portfolio Scenario 2 run, each EE/DR measure's MAP and RAP potential (from the 2020 MPS), across both the residential and business sectors, were combined into a single table and rank by UCT score. Based on this ranking a supply curve was created showing total cumulative annual potential (in 2034, to align with the target capacity shortfall year) and UCT scores. The complete supply curve is shown below.⁵

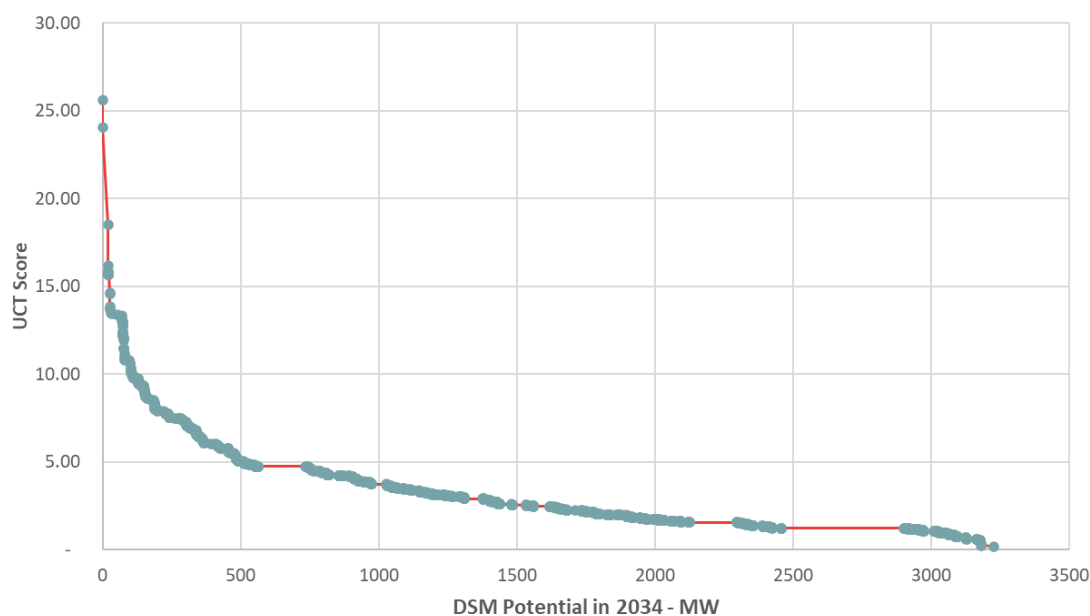


FIGURE 1: 2020 MPS MAP & RAP MEASURE SUPPLY CURVE (CUMULATIVE ANNUAL SAVINGS IN 2034 BY UCT SCORE)

However, it is not possible for the DOPE Portfolio to select both the MAP and RAP permutations of a given EE/DR measure. For the final DOPE Portfolio Scenario 2 analysis, GDS opted to pursue a RAP-preferred approach. This means that if both the RAP and MAP permutation of a measure were available for selection (i.e. to the left of the target capacity need on the x-axis), the RAP permutation would be selected.⁶ As MAP permutations were dismissed along the curve, GDS had to pick up additional measures, moving further right along the curve, until the target capacity need was achieved. In contrast to the Portfolio level DOPE, the measure level DOPE portfolio assumes no pause in EE program delivery and that the selected measures are consistent with the RAP adoption levels beginning in 2022. These programs are assumed to be operated continuously through the analysis period.

Table 2, below, shows a comparison of the 2020 MPS' estimates of RAP and the DOPE Portfolio Scenario 2. In meeting the future resource capacity need in a just-in-time basis, the DOPE Portfolio Scenario 2 has a lower levelized cost (per lifetime MW saved), lower UCT ratio, and lower total NPV costs relative to the RAP estimate.

⁵ Excludes the Income-Qualified potential measures. As noted in the key assumptions, IQ potential savings 'forced' into the DOPE Portfolio as the MPS' IQ Scenario 1 Potential savings level.

⁶ The RAP-preferred option was selected based on the typically higher UCT ratios of using the RAP from the MPS.

TABLE 2: COMPARISON OF 2020 MPS RAP VS DOPE PORTFOLIO SCENARIO 2

	Levelized \$ per Lifetime MW Saved (\$2022)	UCT Ratio	NPV Costs (\$2022, in millions)	Coincident Peak Reduction MW (at meter) in 2036
RAP	\$104,452	2.5	\$1,442	1,608
DOPE Portfolio – Scenario 2	\$93,647	2.8	\$762 ⁷	1,022

Ultimately, 416 measures (excluding IQ measures) were selected to meet the target capacity need. In total, 328 Business EE measures were included in the DOPE Portfolio Scenario 2 analysis, followed by 86 Residential EE measures. Business DR and Residential DR each had one program selected: Capacity Bidding and Pool Pump Load Control, respectively.

The measures were further grouped by sector and end-use. Approximately 95% of the 2034 MW savings from DOPE Portfolio Scenario 2 could be attributed to the Top 10 measure groupings. The pie chart below demonstrates the contribution, by measure group, the contribution to meeting the 2034-2036 resource need under DOPE Portfolio Scenario 2.⁸

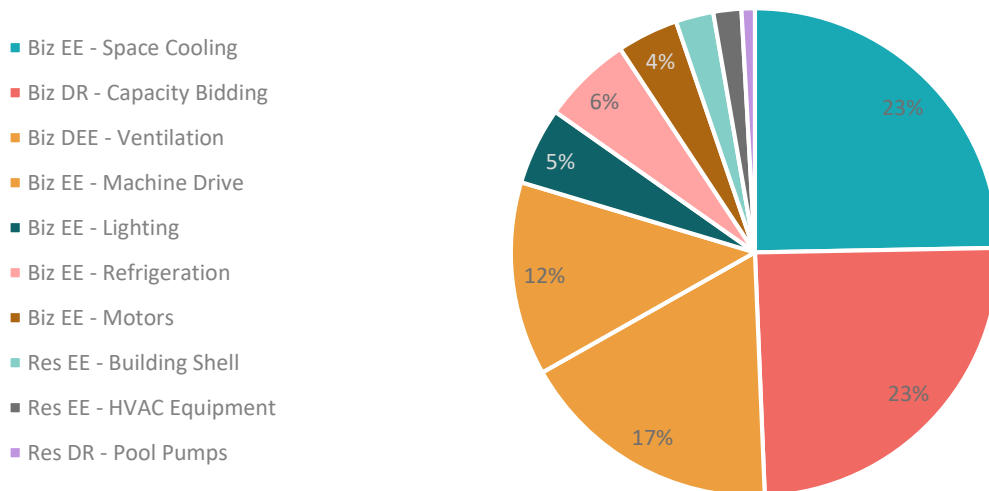


FIGURE 2: DOPE PORTFOLIO SCENARIO 2 - 2034 CUMULATIVE ANNUAL MW SAVINGS BY MEASURE GROUP (TOP 10)

Comparison of DOPE Scenarios to MAP/RAP Potential

Finally, Figure 3 shows a comparison of the DOPE Portfolio Scenarios to meet the targeted capacity need in the 2034-2036 period, relative to the original projections of MAP and RAP potential from the 2020 MPS. Either by deferring sector-level potential in time (Scenario 1) or by prioritizing select measures (Scenario 2), you can meet the capacity short-fall on a “just in time” basis. In addition, Table

⁷ NPV costs in Table 2 are over the same timeframe (2022-2040) as the RAP scenario. If delayed programs are assumed to continue to operate for the same 19-year window, program costs from 2022-2048 would have an NPV of \$774 million.

⁸ The remaining measure groups, comprising 5% of the MW savings, include additional business end-uses (cooking, agriculture, compressed air, space heating, water heating, exterior lighting, office equipment, other, and industrial process) and residential end-uses (appliances, HVAC equipment, lighting, and water heating)

3 provides a comparison of the MAP, RAP, and the two DOPE Portfolio Scenarios according to total levelized cost per lifetime MW saved, total UCT ratio, total NPV Costs, and coincident peak reduction in 2036.

TABLE 3: COMPARISON OF MPS MAP/RAP ESTIMATES TO DOPE PORTFOLIO SCENARIOS

	Levelized \$ per Lifetime MW Saved (\$2022)	UCT Ratio	NPV Costs (\$2022, in millions)	Coincident Peak Reduction MW (at meter) in 2036
MAP	\$172,523	1.6	\$3,490	2,446
RAP	\$104,452	2.5	\$1,442	1,608
DOPE Portfolio – Scenario 1	\$113,760	2.3	\$896	1,140
DOPE Portfolio – Scenario 2	\$93,647	2.8	\$762	1,022

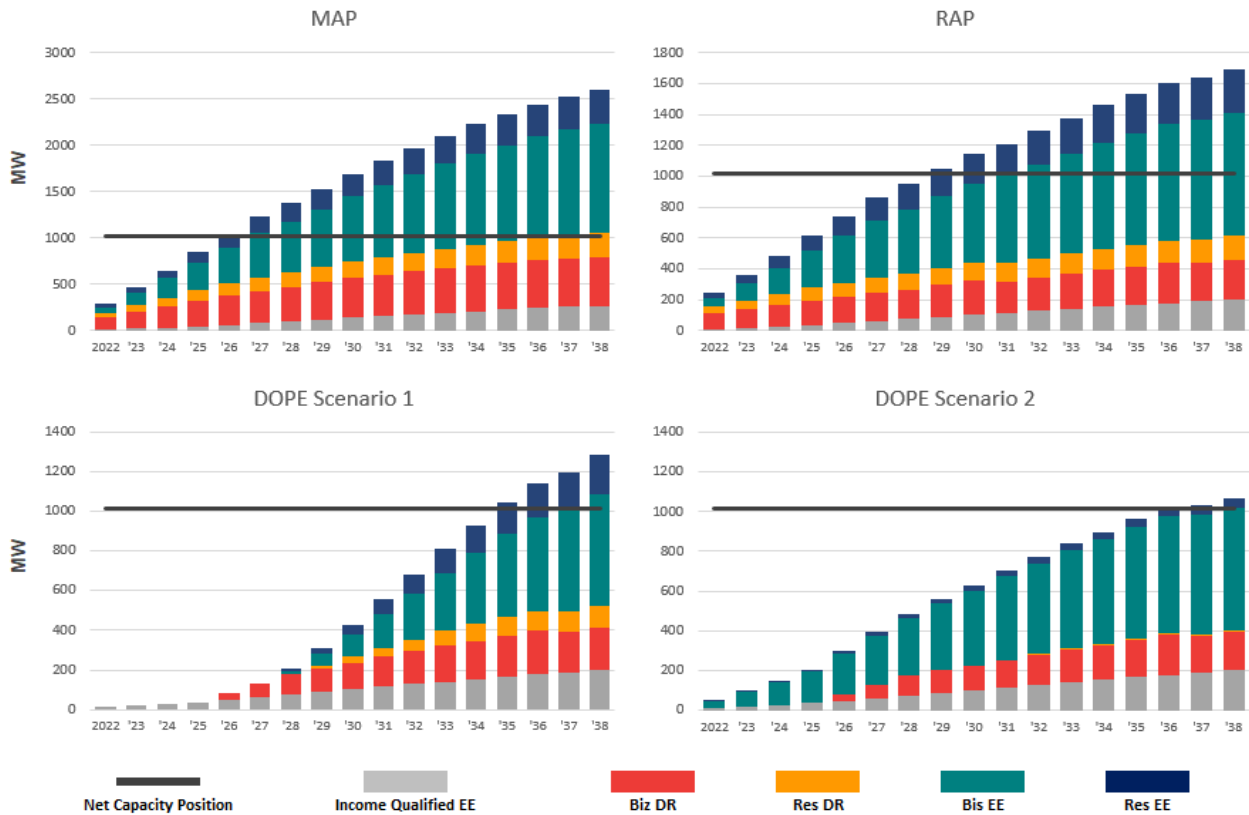


FIGURE 3: COMPARISON OF DOPE PORTFOLIO SCENARIO SAVINGS VS 2020 MPS MAP/RAP