BEFORE THE PUBLIC SERVICE COMMISSION
OF THE STATE OF MISSOURI

In the Matter of a Determination of Special Contemporary Resource Planning Issues to be Addressed by Union Electric Company d/b/a Ameren Missouri in its Next Triennial Compliance Filing or Next Annual Update Report	))))))	Case No. EO-2022-0054

THE OFFICE OF THE PUBLIC COUNSEL'S SUGGESTED SPECIAL CONTEMPORARY ISSUES

COMES NOW the Office of the Public Counsel and, by the September 15, 2021, filing date the Commission ordered on August 26, 2021, suggests to the Commission that it order Ameren Missouri to address the two special contemporary issues set out in the attached verified memorandum in its upcoming 2022 Chapter 22 integrated resource planning annual update report that by rule is due to be filed at the Commission on April 1, 2022, but may be due by October 1, 2022, depending on the scope of the variance the Commission granted Ameren Missouri in Case No. EE-2019-0104.

Respectfully,

/s/ Nathan Williams

Nathan Williams
Chief Deputy Public Counsel
Missouri Bar No. 35512

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Attorney for the Office
of the Public Counsel

CERTIFICATE OF SERVICE

I hereby certify that copies of the foregoing have been mailed, hand-delivered, transmitted by facsimile or electronically mailed to all counsel of record this 15th day of September 2021.

/s/ Nathan Williams

MEMORANDUM

To: Missouri Public Service Commission Official Case File,
Case No. EO-2022-0054

From: Geoff Marke, Chief Economist
Lena Mantle, Senior Analyst
John A. Robinett, Utility Engineering Specialist
Missouri Office of the Public Counsel

Re: Special Contemporary Issues for Ameren Missouri

Date: 9/15/2021

Issue 1: Additive Manufacturing ("AM" or "3D Printing")[1]

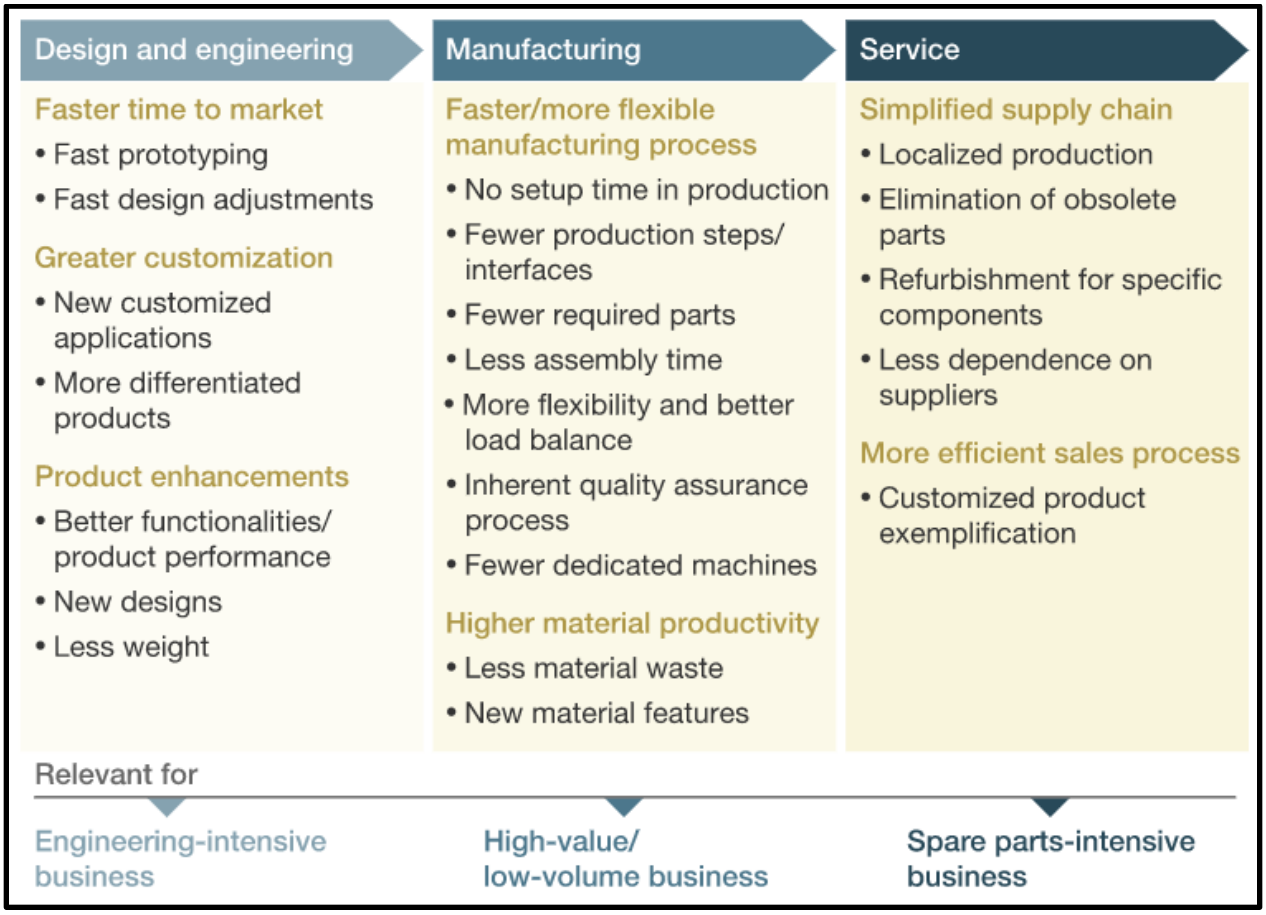
Background:

As it has for prior resource planning filings, OPC is requesting the Commission to include additive manufacturing technology as a cost-saving tool and supply chain risk mitigation measure for resource planning purposes as a special contemporary issue.

Additive manufacturing (AM) is the process of producing objects from computer-aided design (CAD) model data, usually adding layer upon layer, in contrast to conventional subtractive manufacturing methods that involve the removal of material from a starting work piece. AM is also called 3-D printing, additive fabrication, or free-form fabrication. Once employed purely for prototyping, AM is now increasingly used for spare parts, small series production, and tooling. The continued proliferation of AM can provide utilities (and other industries in general) new design flexibility, reduced energy use, and shorten time to market. The number of materials and complexity that AM can handle is constantly expanding and is already a reality in many industries through enhanced benefits listed in Figure 1 from a recent McKinsey Consulting white paper:

[1] Dowd, K. (2020) How 3D printing can help power the energy industry. *BizTech Magazine*. https://biztechnmagazine.com/article/2020/02/how-3d-printing-can-help-power-energy-industry

Figure 1: Enhanced benefits of AM applications[2]



In principle, additive technologies are able to produce almost every part that can be produced by means of traditional procedures. The increase of AM will no doubt have cost and operational implications on an investor-owned utility's cost of service that should begin to be considered as a relevant input in future planning scenarios. Such examples include but are not limited to:

a) Generation construction of wind turbines (or other production plant parts):

The enormity of wind turbines (blades and tower segments) makes it both difficult and expensive to transport materials on the highway to project sites. 3D printing could enable construction at the project site which should result in financial savings. Most recently, a California startup (Reinforced Concrete Additive Manufacturing "RCAM" Technologies) was awarded a grant from the California Energy Commission ("CEC") to develop and test AM printing technology of concrete for turbine towers on-site in the hopes of boosting capacity factors and lowering overall costs.[3]

[2] Kelly, R. & J. Bromberger (2017) "Additive Manufacturing: A Long-Term Game Changer for Manufacturers." McKinsey Consulting. https://www.mckinsey.com/business-functions/operations/our-insights/additive-manufacturing-a-long-term-game-changer-for-manufacturers

[3] Gerdes, J. (2017) Is 3-D Printing the Solution for Ultra-Tall Wind Turbine Towers? GTM. https://www.greentechmedia.com/articles/read/is-3d-printing-the-solution-for-ultra-tall-wind-turbine-towers#gs.uTRMrnsU

b) Lower costs, quicker delivery of spare parts for grid reliability:

Simplification of the supply chain necessary to support grid reliability can be improved by eliminating the need to produce components at different sites or having to store excess distribution and transmission investments in warehouses. With AM, "on-demand" products/parts could be manufactured in proximity to the impacted area following both low- impact, high frequency events (e.g., a power outage from a blown transformer) and high-impact, low frequency events (e.g., severe weather events, earthquake, and electromagnetic pulses). In theory, AM could provide a cost-effective alternative to securing long-lead-time transmission and distribution equipment.

c) Load forecasting implications:

If AM technology were to be adopted and utilized on a macro-scale it could have profound implications on the entire economy. AM has already created homes,[4] cars, and homes[5] + cars.[6] Verhoef, et al. (2018) estimate that AM could lead to a 5-27% reduction in global energy use by 2050 primarily from "material savings, transportation savings, production savings, savings in use phase and in operation and maintenance."[7] Table 1 provides a U.S. Department of Energy assessment of AM impact attributes on both product offerings and supply chain structures.

[4] Cowan, M. (2018) The World's First Family to Live in a 3D-Printed Home. BBC. https://www.bbc.com/news/technology-44709534

[5] Hanley, S. (2018) LSEV 3D-printed Electric Car Costs Just $7,500. How is that Possible? Clean Technica https://cleantechnica.com/2018/03/19/lsev-3d-printed-electric-car-costs-just-7500-possible/

[6] Oak Ridge National Laboratory (2018) ORNL integrated Energy Demo Connects 3D-Printed Building, Vehicle. https://www.ornl.gov/news/ornl-integrated-energy-demo-connects-3d-printed-building-vehicle see video at: https://www.youtube.com/watch?v=RCkQBlFJRN4&feature=youtu.be

[7] Verhoef, et al (2018) The Effect of Additive Manufacturing on Global Energy Demand: An Assessment Using a Bottom-Up Approach. Energy Policy. 112. 349-360. https://www.sciencedirect.com/science/article/pii/S0301421517306997

Table 1: Impact of AM on product offerings and supply chain:

AM Attributes compared to traditional manufacturing	Impact on product offerings	Impact on supply chains
Manufacturing of complex-design products	●	◉
New products that break existing design and manufacturing limitations	●	◉
Customization to customer requirements	●	◉
Ease and flexibility of design iteration	◉	○
Part simplification/sub-parts reduction	○	○
Reduced time to market	○	○
Waste Minimization	○	○
Weight reduction	○	○
Production near/at point of use	○	●
On-demand manufacturing	○	●

Key: Very High ● High ◉ Medium ○ Low ○

OPC is not requesting any specific modeling; rather, we are looking for the utilities to examine the feasibility and potential cost savings implications (if any) of adopting AM technology to maintain present-day investments or for future investments at the generation, transmission, and distribution levels. Stated differently, we believe this technology should have cost saving and reliability implications that merit further research and consideration and would like the utilities to explore this technology within the Special Contemporary Topics sections of its IRP.

Suggestion:

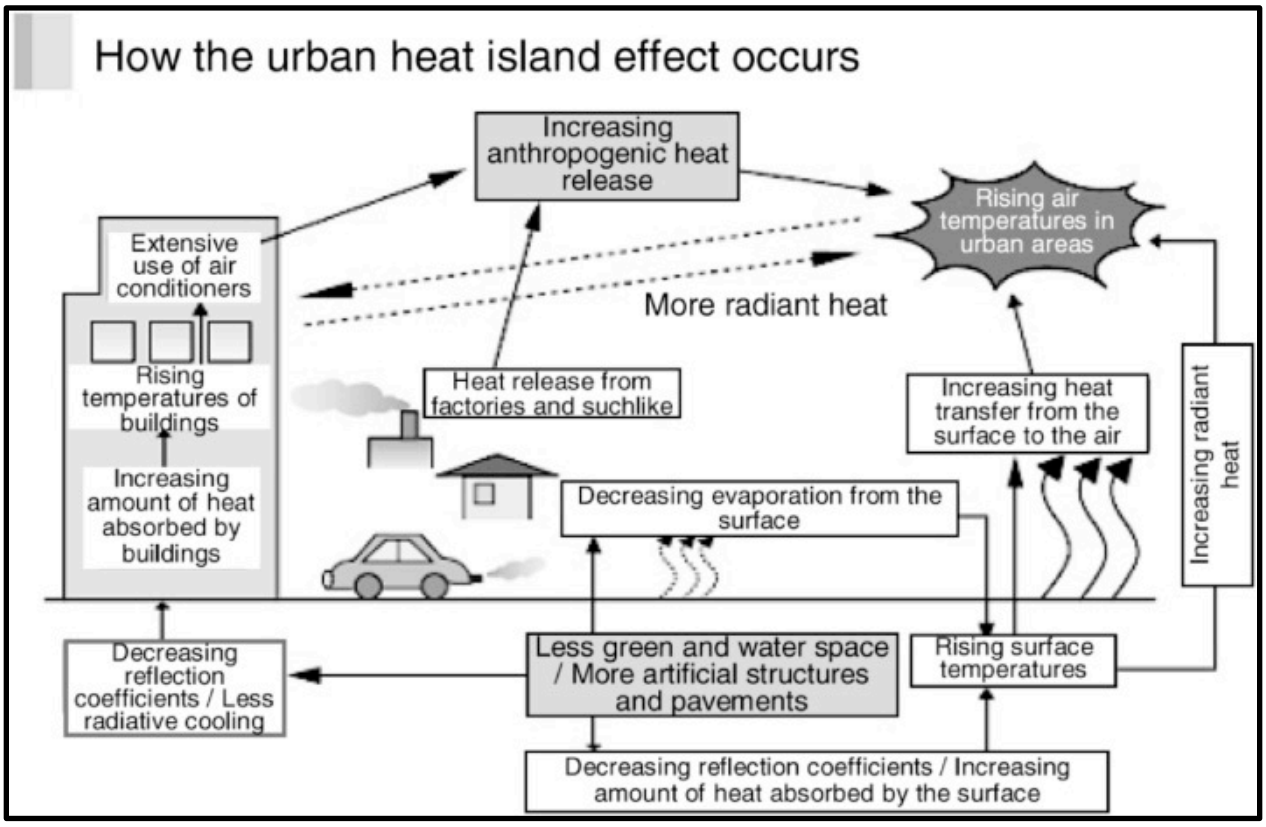
1.) Ameren Missouri should explore this technology within its Distribution, Transmission and Supply Side Generation Chapters as an approved Special Contemporary Topic for its IRP modeling.

Issue 2: Urban Heat Island

Background:

Elevated summertime temperatures in cities increase energy demand for cooling and add pressure to the electricity grid during peak periods of demand, which generally occur on hot, summer weekday afternoons, when offices and homes are running cooling systems, lights, and appliances. Steadily increasing downtown temperatures mean that increased urban-wide demand for electricity is used to compensate for the heat island effect. During extreme heat events, which are exacerbated by urban heat islands, the resulting demand for cooling could overload systems and require a utility to institute controlled, rolling brownouts or blackouts to avoid power outages. Figure 2 provides a graphical illustration of the feedback loop inherent in the phenomenon.

Figure 2: Urban Heat Islands feedback loop



Suggestion:

1.) Ameren Missouri should explore the feasibility, impacts and potential mitigation (e.g., distribution, transmission, supply/demand-side generation) of a potentially more pronounced urban heat island over the greater St. Louis urban area over a twenty-year IRP cycle.

BEFORE THE PUBLIC SERVICE COMMISSION
OF THE STATE OF MISSOURI

AFFIDAVIT OF GEOFF MARKE

STATE OF MISSOURI)
) SS.
COUNTY OF COLE)

COMES NOW GEOFF MARKE and on his oath declares that he is of sound mind and lawful age; that he contributed to the foregoing *Special Contemporary Topics* and that the same is true and correct according to his best knowledge and belief.

Further the Affiant sayeth not.

Geoff Marke
Chief Economist

JURAT

Subscribed and sworn before me, a duly constituted and authorized Notary Public, in and for the County of Cole, State of Missouri, at my office in Jefferson City, on this 15th day of September, 2021.

NOTARY PUBLIC NOTARY SEAL STATE OF MISSOURI

TIFFANY HILDEBRAND
My Commission Expires
August 8, 2023
Cole County
Commission #15637121

Tiffany Hildebrand
Notary Public

My Commission expires August 8, 2023.

BEFORE THE PUBLIC SERVICE COMMISSION
OF THE STATE OF MISSOURI

AFFIDAVIT OF JOHN A. ROBINETT

STATE OF MISSOURI)
) SS.
COUNTY OF COLE)

COMES NOW JOHN A. ROBINETT and on his oath declares that he is of sound mind and lawful age; that he contributed to the foregoing *Special Contemporary Topics* and that the same is true and correct according to his best knowledge and belief.

Further the Affiant sayeth not.

John A. Robinett
Utility Engineering Specialist

JURAT

Subscribed and sworn before me, a duly constituted and authorized Notary Public, in and for the County of Cole, State of Missouri, at my office in Jefferson City, on this 15th day of September, 2021.

NOTARY PUBLIC NOTARY SEAL STATE OF MISSOURI

TIFFANY HILDEBRAND
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My Commission expires August 8, 2023.

BEFORE THE PUBLIC SERVICE COMMISSION
OF THE STATE OF MISSOURI

VERIFICATION OF LENA M. MANTLE

STATE OF MISSOURI	)	
	)	SS.
COUNTY OF COLE	)	

LENA M. MANTLE, under penalty of perjury and on her oath declares that she is of sound mind and lawful age; that she contributed to the foregoing *Special Contemporary Topics* and that the same is true and correct according to her best knowledge and belief.

Further the Affiant sayeth not.

/s/Lena M. Mantle
Lena M. Mantle
Senior Analyst
Office of the Public Counsel