

Revised Analysis Comparing GHG Emissions from Scenes of On-Location and Virtual Productions

Analysis completed in the first-half of 2023

Introduction

In August 2022, ICF delivered to SPE an comparative analysis of estimations emissions from virtual productions and on-location productions to determine whether emissions from the virtual productions were less than or greater than emissions from traditional, on-location productions. The original analysis, using estimated data and emissions, found that for the productions analyzed, the virtual production resulted in 76 to 80% fewer emissions than the traditional, on-location production. These results from the original analysis are summarized in Table 1.

Table 1: Results of Original Comparative Analysis Using Estimated Data

Production	Original On-Location Production Total Emissions	Original Estimated Virtual Production Total Emissions	% Difference Between Virtual Production and On-Location Production
	MT CO ₂ e	MT CO ₂ e	
Production A	3.09	0.61	-80%
Production B	16.47	4.01	-76%

SPE later reported to ICF data from an actual virtual production conducted on SPE's virtual production stage in September 2022. Using this actual reported data, ICF revised our comparative analysis to understand whether virtual productions generated fewer emissions than on-location productions. The results of this revised comparative analysis indicate that, based on the data from the actual virtual production, the virtual production resulted in 52 to 76% fewer emissions than the traditional, on-location production. These results from the comparative analysis are summarized in Table 2.

Table 2: Results of Revised Comparative Analysis Using Data Scaled Based on Results of Comparative Analysis Using Actual Reported Data Compared to Results of Original Comparative Analysis using Estimated Data

Production	Original On-Location Production Total Emissions	Revised Virtual Production Total Emissions	% Difference Between Revised Virtual Production Emissions and On-Location Production Emissions
	MT CO ₂ e	MT CO ₂ e	
Production A	3.09	0.73	-76%
Production B	16.47	7.87	-52%

The revised analysis suggests the same conclusion of virtual productions generating fewer emissions than the same production conducted on-location.

The remaining sections of this document provide more detail on the methodology and results of the revised comparative analysis.

Comparison of Reported Production Electricity Consumption to Estimated Electricity Consumption

SPE reported electricity consumption data and number of hours in prep, shoot, and wrap for the six-day production in September 2022. The data included daily electricity consumption in kWh for the Stage 07 outside electrical distribution, Bubble Room electricity, Stage 07 shooting power/AC, and Bubble Room AC.

These electricity consumption sources corresponded to electricity consumption sources identified in the original comparative analysis. Stage 07 outside electrical distribution corresponds to electricity consumption for the LED panel array, Bubble Room electricity corresponds to electricity consumption for rendering, and Stage 07 shooting power/AC corresponds to the electricity consumption for the virtual stage from the original virtual production analysis. Bubble Room AC did not correspond to any electricity consumption category included in the original virtual production analysis.

To carry out this revised analysis, ICF compared the electricity consumption from each electricity consumption source in the reported data to electricity consumption estimated using the reported production’s number of prep, shoot, and wrap days and the assumptions used in the original comparative analysis to estimate electricity consumption.¹ The reported and estimated electricity consumptions were compared to understand whether ICF’s assumptions for estimating electricity consumption from the original analysis resulted in more or less electricity consumption than the reported data.

Results

Table 3 presents the reported electricity consumption for the September 2022 production compared to the estimated electricity consumption following the assumptions and methodology from the original virtual production analysis that used estimated data. The results show that the original virtual production analysis methodology that estimated electricity consumption underestimated electricity consumption compared to reported, actual electricity consumption data. The reported, actual consumption was 209% greater than what the original electricity estimation method would have predicted for this production.

Table 3: Comparison of Reported and Estimated Data for September 2022 Production.

Electricity Consumption Source	Original Estimated Virtual Production Electricity Consumption	Reported, Actual Virtual Production Electricity Consumption*	% Difference
kWh	kWh	kWh	
LED Panel Array	2,675	7,371	+176%
Rendering	1,879	4,467	+138%
Stage	612	2,896	+373%
Bubble Room AC	N/A	1,243	N/A
Total	5,165	15,977	+209%

N/A indicates not applicable.

¹ See “FINAL_Virtual Productions Methodology Assumptions Results_082322.docx” (delivered August 23, 2022) for more information on the assumptions used in the original comparative analysis.

Applying Results to Virtual Production and On-Location Comparative Analysis

ICF used the results shown in Table 3 to revise our results from the original virtual production analysis that compared emissions from on-location, reported data to estimated virtual production data for two productions, Production A and Production B. To revise the original analysis, we multiplied the estimated electricity consumption for the LED panel array, rendering, and the stage for Productions A and B by the percent differences from Table 1 to scale up the original estimated virtual production electricity consumption and compensate for the underestimation of the original methodology.

Bubble Room AC electricity consumption was also added to these revised calculations. The intensity metric of electricity consumption per hour of production was calculated from the September 2022 reported electricity consumption and incorporated into the revised calculations. The Bubble Room AC electricity consumption per hour of production was scaled up based on the number of hours for Productions A and B.

ICF assumed that all emissions sources other than electricity consumption for the LED panel array, rendering, the stage, and the Bubble Room AC remained the same in this revised calculation, as no reported data was provided for the September 2022 production to assess whether the original methodology was over- or underestimating these emission sources.

The results of this revised analysis show that even with the adjusted, higher electricity consumption, and the addition of the Bubble Room AC, the virtual productions have lower emissions than on-location productions.

Table 4: Summary of Emissions by Scope for On-Location Productions, Original Virtual Productions Analysis using Estimated Data, and of the Revised Virtual Production Analysis Using Data Scaled Based on Results of Comparative Analysis Using Actual Reported Data from Production A and Production B

	Production A			Production B		
	On-Location	Original Virtual Production Analysis	Revised Virtual Production Analysis	On-Location	Original Virtual Production Analysis	Revised Virtual Production Analysis
	MT CO ₂ e	MT CO ₂ e	MT CO ₂ e	MT CO ₂ e	MT CO ₂ e	MT CO ₂ e
Scope 1	2.92	0.22	0.22	12.33	0.15	0.15
Stationary Combustion	1.59	0.19	0.19	1.50	0.04	0.04
Mobile Combustion	1.10	<0.01	<0.01	10.81	0.07	0.07
Refrigerants	0.23	0.03	0.03	0.02	0.04	0.04
Scope 2^a	<0.01	0.06	0.18	0.00	2.05^b	5.91^b
LED Wall Location-Based Purchased Electricity	N/A	0.04	0.12	N/A	1.46	4.02
Virtual Stage Location-Based Purchased Electricity	N/A	<0.01	0.02	N/A	0.09	0.44
Rendering Location-Based Purchased Electricity	N/A	0.01	0.03	N/A	0.50	1.18

Bubble Room AC Location-Based Purchased Electricity	N/A	N/A	0.01	N/A	N/A	0.26
Filming Location Location-Based Purchased Electricity	<0.01	N/A	N/A	IE ^c	N/A	N/A
Scope 3 Emissions	0.17	0.33	0.33	4.15	1.81	1.81
Hotel Stays	0.00 ^d	0.27	0.27	2.59	0.25	0.25
Waste	0.17	0.06	0.06	1.56	1.56 ^e	1.56 ^e
Total GHG Emissions	3.09	0.61	0.73	16.47	4.01	7.87

N/A indicates not applicable.

^a This analysis uses location-based GHG emissions from purchased electricity. Market-based electricity emissions can be provided upon request.

^b Production B's studio used 100% renewable electricity, but emissions from renewable electricity are not included in this analysis in order to provide a conservative comparison between on-location and virtual production scenarios.

^c Included elsewhere (IE) - Electricity necessary for On-Location Production B was provided by on-site fuel sources.

^d Hotel stays emissions are zero MT CO₂e because no hotels were used.

^e Because the total build of physical set elements in Virtual Production B was unknown, to be conservative the same amount of set waste as On-Location Production B was assumed.

Table 5 compares the total emissions for the on-location and the revised emissions for virtual production scenarios for Productions A and B, as informed by the analysis of reported, actual virtual production electricity consumption. This revised analysis found that emissions from the virtual production scenario of Production A were 76% lower than emissions from the on-location production scenario of Production A and that emissions from the virtual production scenario of Production B were 52% lower than emissions from the on-location production scenario of Production B.

Table 5: Results of Revised Comparative Analysis Using Data Scaled Based on Results of Comparative Analysis Using Actual Reported Data Compared to Results of Original Comparative Analysis using Estimated Data

Production	Original On-Location Production Total Emissions	Revised Virtual Production Total Emissions	% Difference Between Revised Virtual Production Emissions and On-Location Production Emissions*
	MT CO ₂ e	MT CO ₂ e	
Production A	3.09	0.73	-76%
Production B	16.47	7.87	-52%

* If the same revised analysis were conducted assuming 100% renewable electricity for the virtual productions, total emissions for Production A would be 3.09 MT CO₂e and 0.55 MT CO₂e for the on-location and virtual production scenarios, respectively, and for Production B would be 16.47 MT CO₂e and 1.96 MT CO₂e for the on-location and virtual production scenarios, respectively. This represents a percent difference between the revised virtual production emissions, assuming 100% renewable electricity, and the on-location production emissions of -82% and -88% for Production A and Production B, respectively. These results suggest that emissions from a production may be decreased significantly by using a virtual production stage powered by renewable electricity as opposed to conducting the production on-location and not using renewable electricity.

The percent decreases in emissions between the on-location and virtual production scenarios for these productions under the revised analysis are less than percent decreases in the original analysis. However, the revised analysis suggests the same conclusion of virtual productions likely generating fewer emissions than the same production conducted on-location.

Scope 1 and 3 emissions associated with mobile combustion from employee transportation and hotel stays, respectively, continue to be the main drivers of emissions under the on-location production scenarios. Virtual productions require less travel than on-location productions, which helps to keep scope 1 and 3 emissions lower.

Limitations

The same limitations included in the memorandum detailing the original analysis continue to apply to this revised analysis.²

This revised analysis includes additional limitations as well. The electricity demand per hour for the September 2022 production may have been different from what would have been required for the productions in the original analysis (i.e., Productions A and B), which may result in an over- or underestimation of electricity consumption in the revised analysis. The electricity consumption for the Bubble Room AC may vary depending on the rendering requirements of the production, so the electricity demand per hour for the September 2022 production may have been different from what would have been required for Productions A and B. Since no information on the Bubble Room AC electricity consumption was provided for the original analysis of the virtual production scenarios for Productions A and B, ICF scaled the Bubble Room AC electricity consumption to Productions A and B on a per hour basis. Additional information on Bubble Room AC electricity intensity may have presented alternative methods for scaling the reported data in this revised analysis.

² See “FINAL_Virtual Productions Methodology Assumptions Results_082322.docx” (delivered August 23, 2022) for more information on the limitations of the original comparative analysis.