

Lights, Camera, Climate Action: Report on Clean Power Alternatives for the Film Industry



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This report has been reviewed by representatives of Metro Vancouver, who commissioned the study, but the interpretation of the results of this study, as expressed in the report, is entirely the responsibility of the consultant authors and does not imply endorsement of specific points of view by Metro Vancouver. The findings and conclusions expressed in the report are the opinion of the authors of the study and may not necessarily be supported by Metro Vancouver.

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Primary research was conducted from March to December 2022
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Executive Summary

The British Columbia film and TV industry, largely located in Metro Vancouver, is a major market in North America. According to the Vancouver Economic Commission (VEC), as North America's third largest film and TV production centre, film and TV is a key industry and economic driver. Annual film spend research, the local film, television, visual effects (VFX) and animation industries generated \$4.8 billion in direct spending for the provincial economy in 2021.*

Metro Vancouver commissioned this study to focus specifically on power needs of film and tv production and associated environmental impacts, looking at use cases across the region's jurisdictions and in three other regions in North America. The report summarises findings from research of publicly available sources and grey literature, a landscape scan, direct engagement with key industry informants in North America and the UK, as well as observations and professional experience working on productions of various sizes and in various regions. Results and recommendations emerging from this effort was supplemented by Green Spark Group's broad industry experience.

Today's film and television production industry is heavily reliant on mobile diesel generators. These are used for energy needs on exterior locations as well as at most studio facilities. As such, BC's film industry consumes an estimated 15-20 million litres of fuel (65% diesel, 35% gas).**

Film production in Metro Vancouver has higher emissions from fuel consumption than other regions, in large part due to the wide market availability of almost exclusively large generators as compared to other jurisdictions. Notably, the consumption of diesel fuel generates both greenhouse gases (GHGs) and air contaminants, such as diesel particulate matter (DPM) and nitrous oxides (NOx), adversely impacting regional air quality and public health. Facilitating access to low carbon electrical power options across Metro Vancouver would help reduce the film sector's contribution to these impacts and help to reduce regional GHG emissions overall.



Credit: Andrew Robinson, Green Spark Group

*Press Release from the Vancouver Economic Commission: B.C. film roars back with record-shattering \$4.8 billion spend in 2021. Dated: September 12, 2022

**Data provided by Suncor, which supplies 60-70% (9-15ML) of the BC film industry's fuel

REPORT FINDINGS

- The way we power our film sets in Metro Vancouver ranks among the most fossil fuel intensive according to a Regional Carbon Emissions report published by the Sustainable Production Alliance*. Depending on the facility and filming location, productions commonly use an average of 3-4 large diesel generators per filming day (sometimes but rarely up to 20).
- Generators are used as the primary source of power on location, but are also commonly used for supplemental power at soundstage facilities.
- The equipment is often oversized for the production's actual power needs and are typically used below 30% of their power capacity as the available equipment is almost entirely large 1400 amp generators.
- Battery power stations exist however, power capacity and cost are two barriers preventing further use. Power capacity, in particular, remains a barrier for circus power applications.
- There is appetite for and increased experience with the use of renewable fuels in the film industry, but limited access in the region continues to be a barrier to use.
- Power limitations are strongest at converted facilities, but productions use generators at purpose-built facilities as well. Given the scale and frequency of filming at soundstage facilities, addressing this issue through facility and grid infrastructure upgrades provides a meaningful pathway to reducing diesel generator use throughout the region.
- Food trucks and events offer the most potential for overlap with filming needs. Both industries often use similarly sized generators which can be replaced with mobile battery power stations, depending on size and application. Similarly, food trucks and events would also benefit from increased grid power access.

Importantly, solutions for the film sector (immediate, short, medium and long term) currently exist for every scenario that currently requires a Diesel Generator:

- The filming industry in Metro Vancouver has the broadest exposure and experience with clean tech alternatives as compared to other film jurisdictions.
- Mobile battery power is increasingly and successfully used for a growing array of needs, and have been able to replace generators for smaller power needs.
- The increasing use and availability of grid ties and power kiosks offers strong potential. There are over 150 established, privately-managed grid tie-ins for productions in the Lower Mainland. Additionally, publicly-managed power kiosks for the film industry are in development and actively being explored in some jurisdictions, none more aggressively than the City of Vancouver.

Recommendations for the Metro Vancouver Regional District and its member jurisdictions:

- Collaborate with member jurisdictions to establish a regional Clean Energy Filming Standard to ensure all facilities provide sufficient grid power access for production all activities and to guarantee that clean energy opportunities are pursued as default power options.
- Expand Non-Road Diesel Engine Emission Regulation Bylaw No. 1161 (NRDEE) to restrict the user (Production), not just the vendor/ generator owner,
- Work with BC Hydro to access existing incentives for power kiosk infrastructure development in high-frequency film sites.
- Work with municipalities and Regional Film Offices to standardize the Clean Energy Policy Framework offered in the City of Vancouver.
- Work with municipalities to encourage access to Renewable Diesel (RD or HVO) at commercial fueling stations.
- Pilot the development of a power kiosk at Metro Vancouver's Regional Parks most frequently used sites, such as the Lower Seymour Conservation Reserve (LSCR) or Capilano River.

* Regional Carbon Emissions report by the Sustainable Production Alliance, July 2022

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Introduction

Metro Vancouver is North America's third largest film and TV production centre. The industry in 2021 spent \$4.8 billion in BC¹, most of this in Metro Vancouver, thereby significantly contributing to the regional economy.² However, today's film and television production industry is heavily reliant on mobile diesel generators. These are used for energy needs, both real and perceived, on exterior locations as well as at most studio facilities.

Notably, the consumption of diesel fuel generates both greenhouse gases (GHGs) and air contaminants, such as diesel particulate matter (DPM) and nitrous oxides (NO_x), adversely impacting regional air quality and public health. Facilitating access to low carbon electrical power options across Metro Vancouver would help accelerate the reduction of the film sector's contribution to these harmful impacts.

This report was developed with the objective of demonstrating the viability of sustainable electrification solutions that can replace generators frequently used for filming throughout Metro Vancouver. Findings from research, interviews and analysis included herein will inform opportunities to support targets specified under Metro Vancouver's *Climate 2050 Strategic Framework*. The Strategic Framework aims to address GHG emissions reductions in alignment with the Intergovernmental Panel on Climate Change's (IPCC) Global Warming of 1.5 °C report,³ as well as Metro Vancouver's *Clean Air Plan*.⁴

Specifically, the report aims to serve the following:

- Support efforts to reduce GHGs and other air contaminant emissions created by diesel generators on film sets in the Metro Vancouver region.
- Support public health improvements by reducing public exposure to diesel particulate matter and other health-harming air contaminants emitted by the diesel generators used in film sets across the region.
- Develop recommendations for scalable clean power alternative solutions in the region for the film industry, and other user groups of portable generators which use non-renewable fuels (i.e., diesel and gasoline), such as large events and the construction industry.
- Identify revenue generating or cost recovery opportunities for local governments.
- Recommend the implementation of a clean power alternative at a Metro Vancouver Regional Park

¹ Vancouver Economic Commission, <https://vancouvereconomic.com/blog/media/bcfilm-spends-4-8-billion-in-2021/>

² Vancouver Economic Commission, <https://vancouvereconomic.com/film-in-vancouver/>

³ Special Report: Global Warming of 1.5 °C, Summary for Policymakers, <https://www.ipcc.ch/sr15/chapter/spm/>

⁴ Metro Vancouver Clean Air Plan, 2021, <http://www.metrovancouver.org/services/air-quality/about/clean-air-plan/Pages/default.aspx>

Methodology

This report summarises findings from research, direct engagement as well as observations and professional experience working on productions of various sizes and in various regions. The methods used to gather data for this report included:

1. Background research and review of publicly available information (industry reports, company websites, municipal and regional government websites, grey literature, etc.)
2. Review of primary energy and fuel consumption data from six productions
3. Interviews and information-gathering sessions with key informants, including:
 - a. Representatives from studios facilities, industry vendors and equipment suppliers in four key study regions (Metro Vancouver, Greater Toronto, New York City and Los Angeles);
 - b. Industry professionals such as producers, locations managers and generator operators;
 - c. Representatives from available Metro Vancouver municipalities and BC Hydro;
 - d. Members of Metro Vancouver industries that use or access mobile power;
 - e. Case study interviews.

Information was subsequently collated, aggregated and analysed for trends and insights. Results and recommendations emerging from these were supplemented by Green Spark Group's broad industry experience.

Interviews were an essential part of this project to ensure that all feedback about barriers and opportunities were grounded in industry member experiences. Efforts were made for information to be aggregated and anonymized. The intention of this report is to show impacts and areas for improvement at an industry level. The contributions from the key informants, industry representatives, and vendors are greatly appreciated.

Glossary: Where and Why Power is Required on Productions

The size, scale and budgets of film, TV, and commercial productions vary widely. Each has unique power needs when filming on location or in a soundstage facility. The following common industry specific terms relate to activities, departments, or facilities with power needs.

Circus/Basecamp

Circus, also known as basecamp or unit base, is where trailers needed for costumes, cast, producers, bathrooms, outdoor lighting, hair and make-up, and offices (among others) are parked. If filming on location, to accommodate the various trailers, circus is typically located in a parking lot as close to the filming location (set) as possible. Shuttle vans often take cast and crew members to the actual film set from circus. When filming at a studio facility, circus is still required and usually parked in the facility's parking lot.



Circus can be powered by either grid power (when and where available) or a diesel generator. Circus generators are usually large and can provide 1400-1800A of power. Some soundstage facilities have enough power and connections to accommodate circus power needs when it is parked in the studio lot.

Basecamp photo credit: Midtownmojo.com

Work/Equipment Trucks

Work trucks, also known as equipment trucks, are large diesel trucks and tractor-trailers which contain specialized production equipment for specific departments (e.g., camera, grip, electrics, props, special effects (SPFX), etc.). Each requires its own truck. Depending on the number of work trucks, site size and layout, trucks are parked just outside the filming location, or on nearby streets as close to the set as possible.

Work trucks require power once parked to allow crew members to work with their equipment and to control cabin temperature for drivers. Power can be supplied through smaller diesel and gas generators, circus generators, mobile battery power stations, or grid power.

Catering

Catering trucks are typically powered by diesel generators. If they move locations between breakfast and lunch, they may require another distinct power source depending on available power at each site. Catering can also be adequately powered with mobile battery power stations if grid power is not available. Catering trucks are parked near wherever a designated lunchroom is, such as in a studio facility backlot, near a building rented for a lunch space, or at circus.

Catering services vary across production regions. In Metro Vancouver, catering services are often provided through a truck that cooks, heats, and serves meals to the crew. They are typically equipped with propane ovens, fryers, griddles, and require power for electric kitchen appliances.

Craft/Craft Services

Craft services provide all non-meal food and snacks to crew throughout the day and are usually provided by trucks parked near set. Craft services are typically powered by a diesel or gas generator. However, craft trucks can also be adequately powered with mobile battery power stations if grid power is not available.



Work Trucks and Craft Services in a Metro Vancouver Regional Park, Credit: Andrew Robinson, Green Spark Group

Studio/Soundstage Facility

A studio or soundstage facility can be either a purpose-built or converted building where lighting can be controlled, and sound insulation is acceptable for filming. The facility will also typically hold the Production Office, as well as work areas for specific departments such as Construction, the Art Department, and Wardrobe/Costumes, among others. These facilities typically have large parking lots for production support vehicles (i.e., circus and work trucks). Some have backlots (outdoor spaces used for filming) either adjacent or nearby the facility.

Soundstage facilities use grid power for offices, buildings and backlot. Generators may also be used for filming in stages and backlots, and additional power needs, such as air conditioning. Support vehicle parking areas are also commonly powered by diesel generators.

Location Filming

When productions film “on location”, they are using spaces other than the soundstage facility for filming. When on location, productions bring mobile power for all power needs, usually in the form of fossil fuel generators. Circus and other work areas typically have their own generators. Additionally, film crews typically power set lighting with its own dedicated generator to avoid the risk of power surges and interrupting the filming process. Mobile battery power stations and grid power can also be used if available.



Filming on location can be indoors or outdoors. Productions typically park the circus trailers and work trucks in nearby parking lots or along streets when on location. Permits or approvals are required from the local jurisdiction to film on location. There is a specific Locations Department to manage this process for productions.

*Exterior Location Filming, Night Scene,
Credit: Samantha Leigh, Green Spark Group*

Filming on Set/Film Set

The film set is where filming occurs, either on soundstages within studio facilities, or areas used for filming while on location. Set refers to both the filming area as well as the constructed and designed spaces for the production’s story. Whether set is on stage or on location, productions bring along lighting and other electrical equipment to meet the creative requirements for filming (e.g., camera, sound recording, and video playback equipment). As such, power needs for set vary depending on the equipment, but it is essential for productions to have reliable, consistent power. Film crews primarily use diesel generators to provide them with consistent, reliable mobile power, thereby creating a dependency on this technology.

Generators

Fossil fuel generators are ubiquitous on productions as a source of power. Productions may use as few as 2 or as many as 20 generators of various sizes depending on power needs, budget, and site layout. When filming on location (i.e., outside of a studio facility), generators are *almost always* used to supply power. The vast majority of production power in the North American industry is supplied by diesel generators, many of which are tractor-mounted or towable. Outside North America, some generators also run on natural gas or propane.

The film industry typically discusses these generators in terms of amperes (A, amps). Diesel generators have a large range of sizes and capacities, typically between 400A to 1800A for film

industry use, although the median-use diesel generator is 1000A - 1400A depending on regional availability and power needs (see [Appendix 1B](#)). Small, portable generators run on gas and supply between two (2) to 7.5 kW (2.7-10 hp) of power. This is sufficient for bathroom trailers, work lights, construction work, and to power other small loads for short periods of time.

Regardless of size, generators emit harmful pollutants such as particulate matter (PM), nitrogen oxides (NOx), and carbon monoxide (CO), which contribute to both short and long-term health effects. Generators also emit greenhouse gases such as carbon dioxide (CO₂). In North America, generators are rated from Tiers 0-4 which indicates the levels of pollutant emissions based on design, with Tier 0 being the oldest and highest polluting, and Tier 4 being the newest and least polluting.⁵



Top: Large 1400A Diesel generator. Bottom: Small 2kW generator with work truck, Andrew Robinson, Green Spark Group.



⁵ [Regulations for Emissions from Heavy Equipment with Compression-Ignition \(Diesel\) Engines | US EPA](#)

Section 1 – Power and the Motion-Picture Industry: Current State

This section summarizes current practices in energy consumption within Metro Vancouver, as well as three additional North American motion-picture industry filming hubs. An overview of perspectives on how municipalities can help productions switch to clean power is also included.

Information was gathered from May – November 2022 through key informant interviews with facility representatives, generator operators, vendors, film liaisons, studio representatives, sustainability representatives, as well as relevant municipal staff. Research and engagement covered four regions: Metro Vancouver, the Greater Toronto Area, New York City, and Los Angeles. Interview results are supplemented by Green Spark Group's professional industry experience.

Finally, a summary of data and practices from six productions across these four North American municipalities is provided at the end of this section. Available data is included to highlight recent clean technology efforts and broad fuel consumption findings. All productions were supported in these efforts by Green Spark Group as other data were unavailable.

The current state summary includes:

- [Soundstage Facility Power](#)
- [Mobile Power](#)
- [Grid Tie-ins and Power Kiosks](#)
- [Regulations and Incentives for Clean Power](#)
- [Green Spark Group Sample Production Data](#)

[Appendix 1](#) provides a comprehensive account of the research and engagement results summarized in Section 1 below. Key informant and research sources are provided in [Appendix 8](#).

Soundstage Facility Power

Facility Power Availability	
Metro Vancouver	<ul style="list-style-type: none"> • Facility power is sufficient to address needs related to the production office, and most set/soundstage filming and lighting needs. • High demand for soundstage facilities, and a current industry-wide shortage of these facilities, leads to legacy buildings, such as warehouses, being converted.⁶ In 2022, Metro Vancouver had 5 purpose-built and 29 converted soundstages.⁷ A number of new large-scale soundstage facilities are currently in development. • Most facilities have insufficient power to meet all of a production's needs (e.g., stage, work trucks and trailers) and generators are used to supplement additional power needs. • Power constraints emerge when productions require supplemental power for parking support purposes.⁸ (See Section 4 – Generator Use on Studio Blocks.)
Other Jurisdictions	<ul style="list-style-type: none"> • Toronto facilities face similar power limitations than those in Metro Vancouver. • New York and Los Angeles have many purpose-built facilities. Supplemental power is occasionally required. (See below, Generator Use at Facilities.) • Across North America, 14% of facilities have existing on-site clean energy projects, 63% procure some renewable energy utilities.⁹
Generator Use at Facilities	
Metro Vancouver	<ul style="list-style-type: none"> • With existing infrastructure, productions almost always use diesel generators to supplement grid power at facilities. • Large 1400 to 1600A diesel generators are widely available and used to add supplemental power. Smaller generators are in limited supply with local suppliers and rarely asked for. • Generators typically run at least 80% of the time at 'inefficiently low loads' (under 300A, or less than 25% capacity) over a 14+ hour filming day.¹⁰
Other Jurisdictions	<ul style="list-style-type: none"> • Generators are used at Toronto facilities similarly to Metro Vancouver. • New York productions commonly use generators for support vehicle parking. • Generators are not typically used at LA facilities as most have adequate grid power.
Peak Power Demand Scenario	
All Regions Surveyed	<ul style="list-style-type: none"> • Peak power demand occurs when all stages are in use simultaneously; the parking lots are full; air conditioning is in use; and lighting, special effects, and other equipment require separate power. • Quantitative consumption data on peak power demand was unavailable.

⁶ See Glossary, [Studio/Soundstage Facility](#)

⁷ See [Section 4 – Generator Use on Studio Blocks](#)

⁸ For example, circus and work truck parking. See Glossary, [Circus/Basecamp](#) and [Work Trucks](#)

⁹ Sustainable Production Alliance. [SPA Soundstage Facility Survey Key Takeaways](#). May 2022.

¹⁰ Kamela Cosacchi, Valid Manufacturing. [Getting Out of the Studio: High Efficiency Portable Generators for Film Production](#). Jan. 10, 2023

Electric Vehicle (EV) Charging	
Metro Vancouver	<ul style="list-style-type: none"> • EV charging stations at facilities in Metro Vancouver are more common than in the other regions surveyed. • At least 5 facility owners provide Level 2 EV charging for productions in various locations, with more being developed in the near future. • Existing regional EV infrastructure further facilitates productions' use of EVs.
Other Jurisdictions	<ul style="list-style-type: none"> • In Toronto, New York, and Los Angeles, some facilities provide EV charging, but EV charging capacity is limited within the regions. • Some productions invest in upgrading to EV charging if they will be using a facility for a longer period.
Barriers to Using Grid Power for All Production Needs	
All Regions Surveyed	<ul style="list-style-type: none"> • Excluding LA and one Metro Vancouver studio, facilities typically do not have grid ties or power kiosks available in their parking lots. • Converted facilities (such as old warehouses) typically either have site infrastructure constraints, or limited capacity at local grid substations, which limit their ability to upgrade power. • Converted facilities are leased by management companies that operate on a rental model, making investment in costly upgrades unappealing.

Mobile Power

Generator Sizes and Market Availability	
Metro Vancouver	<ul style="list-style-type: none"> • Productions use an average of 3-4 diesel generators per day, though using 6-8 generators is common depending on the location and filming power needs. Some productions may use up to twenty generators. • The most common are large (1400 A Tier 3) generators, yet research shows that they are consistently used below the recommended minimum 30% capacity for optimal performance.¹¹ • Tier 4 generators are currently rare in the local market. One equipment supplier began piloting a Tier 4 and battery hybrid power system in 2023. • Wide market availability of almost exclusively large generators, coupled with the habits and preferences of local generator operators, means that productions in Metro Vancouver have higher emissions from fuel than other regions.¹²
Other Jurisdictions	<ul style="list-style-type: none"> • The majority of generators used by the film industry are Tiers 2-3, with Tier 4 and hybrid battery-diesel generators recently hitting the market. • Other jurisdictions are similar to Metro Vancouver in the numbers of generators used when filming on location, although sizes can vary. • Generators come in more sizes in other jurisdictions, ranging from 400 - 1800 A. The median generator size across all surveyed regions is 1000 - 1400 A.

¹¹ Valid Manufacturing. [How to Power your Film Set Efficiently](#). July 13, 2022.

¹² Sustainable Production Alliance. [Close Up Look in North America: Regional Analysis of Film and Television Carbon Emissions](#). July 2022.

Mobile Battery Power	
Metro Vancouver	<ul style="list-style-type: none"> • Research suggests that Metro Vancouver is both more experienced and better equipped with mobile batteries than other film jurisdictions. • A range of battery sizes from 2 kW (2.7 hp) to 96 kW (128.7 hp) are available from a variety of vendors and suppliers. Hybrid battery-generators have also been developed, are newly on the market, and are undergoing pilot testing. • Many productions have used battery power for catering, work trucks, special effects, or to combine batteries with diesel generators for large power needs. • Workshops run by local unions and Creative BC in late 2022 and early 2023 have been building awareness and industry exposure to this technology.¹³
Other Jurisdictions	<ul style="list-style-type: none"> • Other jurisdictions surveyed have access to smaller mobile batteries (for example, 2 kW and 5 kW units) with limited access to larger batteries. • 43% of facilities across North America rent out mobile battery power stations.¹⁴ • Equipment rental companies interviewed in Toronto, New York, and Los Angeles observed that demand for mobile batteries is increasing, and the range of product offerings is diversifying.
Barriers to Using Mobile Battery Power Stations	
Metro Vancouver	<ul style="list-style-type: none"> • Frequently mentioned drawbacks are power limits (few mobile batteries operate above 600 A) and charging times (2-5 hours, depending on battery size and charger capacity). • Cost is a key barrier to greater uptake. Across the three main equipment suppliers, daily rental rates for battery power stations are 32-400% more expensive than for generators with similar power outputs (see Appendix 7B for a cost comparison). However, depending on use and capacity these up-front costs can be reduced and possibly eliminated through fuel savings. • Ensuring that power supply outweighs anticipated power needs is a deeply embedded practice in the film industry, so crews prefer to use large generators for all needs. Educating the workforce on effective battery use is a key challenge. • Lack of charging infrastructure coupled with irregular filming schedules leads to power capacity anxiety about mobile battery power stations.
Other Jurisdictions	<ul style="list-style-type: none"> • The other regions surveyed face similar barriers. Further, other regions have a more limited supply of batteries than Metro Vancouver.
Solar Power and Other Renewable Energy	
All Regions Surveyed	<ul style="list-style-type: none"> • Solar power for mobile applications is available in all four production regions at a small scale, most commonly on trailers. • Alternate forms of renewable energy were not mentioned in interviews.
Alternative/Renewable Fuels	
Metro Vancouver	<ul style="list-style-type: none"> • Renewable Diesel (RD) is available yet not widely accessible to productions due to limited refuelling locations, namely a single cardlock facility in Langley. • RD has been successfully piloted with generators on at least three Metro Vancouver

¹³ Creative BC, [Clean Energy Battery Workshop](#)

¹⁴ Sustainable Production Alliance. [SPA Soundstage Facility Survey Key Takeaways](#). May 2022.

	<p>productions. One local equipment supplier provides a full tank of RD in their equipment when initially rented, though refuelling is controlled by productions.</p> <ul style="list-style-type: none"> • In 2021, the film industry used about 150 thousand litres of RD compared to 9.75 million litres of fossil diesel.¹⁵
Other Jurisdictions	<ul style="list-style-type: none"> • RD is available for productions on many LA studio lots and at some common refuelling stations in California. • Fuels such as RD and renewable natural gas (RNG) are not commonly used across the North American film industry due to limited availability. • There is no studio mandate for RD, although the Sustainable Production Alliance (SPA)¹⁶ actively encourages its use on productions where it is available. • Only 66% of North American facilities allow RD in rental equipment.¹⁷
Urban versus Rural Locations	
All Regions Surveyed	<ul style="list-style-type: none"> • Creative needs (e.g., day vs. night filming) and site layout (e.g., parking lot or along city streets) determine the amount of power and number of generators needed more than the specific location. • Some productions have combined generators with batteries to reduce generator runtime and overcome this barrier. • Urban locations do not necessarily provide more access to grid power than rural locations. (See below, Grid tie-ins and Power Kiosks) • As more grid ties are encouraged, developed, and mapped across Metro Vancouver, greater potential for decreasing generator use is anticipated in urban versus rural settings.

Grid Tie-ins and Power Kiosks

Cost and Availability to Productions	
Metro Vancouver	<ul style="list-style-type: none"> • Usage fees for productions are competitive with generator rental fees, though rates are adjustable by site owners. For example, the Vancouver Art Gallery charges \$250/day as at September 2022. • As at December 2022 there are 154 grid tie-ins available to the film industry across the Lower Mainland. Almost all are privately managed.¹⁸ • The City of Vancouver is installing 25 publicly funded grid tie-ins (power kiosks) over the next eight years to create a city wide network.¹⁹ The most recent kiosk was officially opened downtown in April 2023 (Pacific Blvd.) in one of the city’s most frequently used basecamp sites.²⁰ • The City of Surrey also has grid-ties to service filming at and near City Hall, and other Metro Vancouver municipalities are planning grid tie-ins. As at April 2023, The City of Maple Ridge has a Draft 2023-2027 Capital Plan before Council that includes

¹⁵ Data estimates provided by Suncor, the primary RD fuel supplier in Metro Vancouver.

¹⁶ SPA is a consortium of the world’s leading motion picture, television and streaming companies dedicated to accelerating the transformation of the entertainment business into a more sustainable industry.

¹⁷ Sustainable Production Alliance. [SPA Soundstage Facility Survey Key Takeaways](#). May 2022.

¹⁸ According to Creative BC’s [Grid Power Access Map](#). More locations continue to be added to the map.

¹⁹ [Film Production Clean Power Network](#). City of Vancouver. Accessed April 14, 2023.

²⁰ [City delivers renewable boost for film industry with new clean energy kiosks](#). City of Vancouver. Accessed April 14, 2023.

	<p>“Electrification of the Rail Lot (22410 Haney Bypass)” (page 40).</p> <ul style="list-style-type: none"> • In 2022, BC Hydro established a three-year funding mechanism to help qualifying municipalities offset up to 50% of the cost of designing and installing infrastructure for film industry power kiosks.²¹ To date, one municipality has applied for funding. • Creative BC’s Power Tie-ins Program also provides up to \$2,500 in support of electric grid tie-in projects.²²
Other Jurisdictions	<ul style="list-style-type: none"> • Power kiosk development in Vancouver has directly informed similar efforts in other regions, including the City of Toronto.²³ In Toronto, costs include a \$400 administration fee plus local electricity rates based on consumption. • In Los Angeles, three publicly funded grid tie-in locations have been available since 2007. However, they are severely underutilized due to a lack of communication and awareness. Efforts are underway to address this. • There are no publicly funded grid tie-ins available or in development in New York.
Tracking Grid Power Use by Productions	
Metro Vancouver	<ul style="list-style-type: none"> • At the Vancouver Art Gallery, the property manager tracked 159 filming days where productions used the available grid tie-ins (see Section 3 – Case Study 4: Grid Tie-ins). • The City of Vancouver keeps track of the number of productions that receive 50% rebates through the clean energy incentive. In 2021, about 30% of the approximately 500 productions benefited from the incentive.
Other Jurisdictions	<ul style="list-style-type: none"> • Toronto’s film permit office has been collecting data about production power usage for the past three years to drive their power kiosk project. The City of Toronto will track electricity consumption at all publicly funded power kiosks. • Neither Los Angeles nor New York provided information about electricity use data for productions connected to grid tie-ins.
Barriers to Use	
Metro Vancouver	<ul style="list-style-type: none"> • Property managers of filming locations may be hesitant of productions using grid power due to the risks of overburdening their infrastructure. • Upgrading power availability can be expensive for property owners. Infrastructure limitations leading to high costs are a particular challenge for installing power kiosks. • Human behaviour and industry resistance to change is a common challenge for all jurisdictions. • Limited awareness, however, the City of Vancouver and Creative BC’s engagement efforts with industry stakeholders are strongly attributed with increased usage of grid power on productions.
Other Jurisdictions	<ul style="list-style-type: none"> • Toronto faces similar challenges as in Metro Vancouver. Recent developments including the Ontario Green Screen Grid Tie-in Map and the City of Toronto’s power kiosks are helping overcome these barriers. • In Los Angeles, existing grid tie-ins are underutilized due to communication challenges and the fact that some are located inconveniently for productions.

²¹ [Electric power for film sets](#). BC Hydro. Accessed Jan 12, 2023.

²² [Power Tie-Ins Program](#). Creative BC. Accessed Dec. 14, 2022.

²³ [City of Toronto to install two power drops at filming hotspots to help film productions reduce emissions](#). Sep. 6, 2022.

Regulations and Incentives for Clean Power

Air Quality Regulations	
Metro Vancouver	<ul style="list-style-type: none"> • Air quality regulations do not specifically require the use of clean energy alternatives to fossil fuels. • Metro Vancouver's Non-Road Diesel Engine Emissions Regulation (NRDEE) aims to reduce air contaminants and GHG emissions from non-road diesel engines, including generators. • There are no air quality regulations at the municipal level.
Other Jurisdictions	<ul style="list-style-type: none"> • Air quality regulations in other regions are similarly not specific to the use of clean energy alternatives.
Film Permit Requirements	
Metro Vancouver	<ul style="list-style-type: none"> • Film permits do not usually require the use of clean power, with some exceptions where grid power is available. • Productions at the Vancouver Art Gallery (VAG) site are required to refrain from generator use unless justified to be absolutely necessary. • Generators are restricted in certain sensitive areas such as near bodies of water or near building entryways and windows.
Other Jurisdictions	<ul style="list-style-type: none"> • Film permit requirements in other regions do not require productions to use clean power.
Financial Incentives	
Metro Vancouver	<ul style="list-style-type: none"> • City of Vancouver: Productions able to prove they have eliminated one generator by using a mobile battery or grid tie-in receive a 50% rebate on filming permits under the Clean energy incentive. Film permits are \$1300/day or \$2000/night. <ul style="list-style-type: none"> ◦ More productions will be able to capitalize on this incentive as Vancouver continues to build a citywide network of industry specific power kiosks at the most commonly used parking and film locations.²⁴ • City of Surrey: Productions receive \$500 off their location fee while filming at a civic location such as a swimming pool by tying into the City's available house power. • Metro Vancouver Regional Parks: Since 2021, incentives of \$500/day for up to two days of filming are provided to productions through a Clean Energy Discount. • Grid power connection charges and electricity fees are generally more cost effective than generator rentals and fuel.
Other Jurisdictions	<ul style="list-style-type: none"> • In Toronto, grid power fees are cost effective for productions as compared to generator rental and fuel fees. • There are no incentives for productions to use clean power in LA or New York.

²⁴ City of Vancouver. [Help build a clean power network for film production in Vancouver](#)

Green Spark Group Sample Production Data

Relevant fuel and energy production data from six Green Spark Group clients were reviewed for productions based in Metro Vancouver, Greater Toronto, New York, and Los Angeles between 2017-2021. They were chosen based on similar production type and size as well as data availability to assess current state practices (see Table 1, page 20). Each production's data is summarized in greater detail in [Appendix 1F](#). Findings from these productions include:

- Productions do not consistently or adequately track where the fuel is consumed (the amount of fuel used by vehicles compared to generators), nor do they consistently track fuel type (gas or diesel). This is a key area for improvement to help inform fuel purchase and consumption decisions as well as opportunities for reduction.
- Only three of the sample productions used renewable fuel (Renewable Diesel and biodiesel). Lifecycle emissions reduction rates for the fuels are unknown.
- Trial testing of mobile battery power stations on productions was common across five of the sample productions based in the aforementioned jurisdictions. This indicates an increased desire for clean tech solutions, and that a growing number of film production crew members are becoming familiar with the technology.
- Mobile batteries were primarily deployed for smaller applications and power needs (e.g., catering, work trucks, etc.), though larger batteries were also successfully deployed.
- Only one production had grid-ties available on their lot for continuous use.

Table 1 (following page) highlights important gaps in data tracking for these categories. The absence and/or inconsistency in the completeness of data tracking underscores the challenges in the industry to adequately understand current practices and their impacts. Recommendations to address this challenge within Metro Vancouver are included in [Section 7 – Regulatory Environment](#).



Available battery power technology from various regional manufacturers has the capacity to displace most diesel generator applications. Credit: Valid Manufacturing

Table 1: High-level Summary of Six Green Spark Group productions (2017-2021).

Sample Production City		1	2	3	4	5	6
Sample Production City		Metro Van	Metro Van	Metro Van	Toronto	New York	LA
Utilities	Electricity (kWh)	62,912	508,574	455,715		131,118	472,979
	Natural Gas (MJ)		2,256,430	2,484,900			
Generator Fuel	Diesel (L)					22,838	91
	Gas (L)		54			869	
Vehicle Fuel	Diesel (L)		168,823			48,741	33,842
	Gas (L)		255,150			103,671	34,108
Unknown Use Fuel	Diesel (L)	234,740	4,253	222,605	146,899		
	Gas (L)	20,461	1,385	219,053	389,088		
	Propane (L)	20,461		9,081			
Clean/Alternative Power	Types Used						
Grid Tie-ins (kWh)							37,520
Solar/Other Renewable Energy				Solar Trailers	Solar Trailers		
Mobile Batteries		VOLTstack ²⁵ 5k, 13k	VOLTstack 5k, 13k	UPS ²⁶ (x2)	CINETRIX ²⁷	VOLTstack 5k, 13k	
Biofuels/Renewable Diesel	Renewable Diesel			Biodiesel (B100)		Renewable Diesel	



Renewable Diesel is currently available in 600 fuel stations in California.
Credit. www.76.com/renewablediesel

²⁵ VOLTstack batteries from [Portable Electric](#).

²⁶ Urban Power Source towable battery from [MBS Equipment Company](#).

²⁷ CINETRIX batteries from [Camera Revolution](#).

Conclusion and Key Takeaways

Film productions in Metro Vancouver have higher emissions from fuel consumption than other regions, in large part due to the wide market availability of almost exclusively large Tier 3 generators as compared to other jurisdictions, coupled with the habits and preferences of local generator operators. An important finding that relates to this emissions profile is that generators are used not only on location, but that they are also overwhelmingly used at soundstage facilities to overcome infrastructural power limitations. Power limitations are strongest at converted facilities, but productions use generators at purpose-built facilities as well. Given the scale and frequency of filming at soundstage facilities, addressing this issue through facility and grid infrastructure upgrades provides a meaningful pathway to reduce diesel generator use throughout the region.

Further, depending on the facility and filming location, productions commonly use an average of 3-4 large diesel generators per filming day (and sometimes as many as 20). As the available equipment is almost entirely large 1400 A generators, the equipment is often oversized for the production's actual power needs and are typically used below 30% of their power capacity.

In contrast, the filming industry in Metro Vancouver has the broadest exposure and experience with clean tech alternatives as compared to other film jurisdictions. Mobile battery power is increasingly and successfully used for a growing array of needs and have been able to replace generators for smaller power needs. Power capacity and cost are two barriers preventing further use. Power capacity remains a barrier specifically for circus power applications.

In this regard, the increasing use and availability of grid ties and power kiosks offers strong potential. There are over 150 established, privately managed grid tie-ins for productions in the Lower Mainland. Additionally, publicly managed power kiosks for the film industry are in development and actively being explored in some jurisdictions, none more aggressively than the City of Vancouver. Where available, grid tie-ins immediately eliminate fossil fuel generators and the resultant emissions for filming. Film permit rebates in Metro Vancouver Regional Parks and the City of Vancouver have successfully incentivized productions to explore and adopt clean power alternatives. As mobile battery and hybrid-power systems become increasingly available, in tandem with growing municipal grid-tie infrastructure, such incentives can help accelerate the transition away from diesel generator use across the region.



The Sustainable Production Alliance (SPA) is a consortium of the world's leading motion picture, television and streaming companies (see logos above) which encourages the use of renewable diesel on productions in any jurisdiction that offers it if it is affordable, accessible and meets low carbon fuel standards.²⁸

²⁸ [Open letter](#) from the Sustainable Production Alliance encouraging the use of renewable diesel.

Section 2 – Clean Power Opportunities with Other Sectors

Access and use of clean portable power alternatives across Metro Vancouver offers potential joint opportunities for other industry sectors in addition to film and television production. This section summarizes a landscape scan and engagement of industry representatives from four sectors known to have mobile power needs, namely:

- [Food Trucks](#),
- [Events](#),
- [Landscaping](#),
- and [Construction](#).

[Appendix 2](#) provides a detailed account of feedback from key informant interviews.

	Food Trucks	Events
Current State	<ul style="list-style-type: none"> • Sector relies heavily on portable generators for appliances. • Primary power sources are portable 2kW (2.7 hp) gas generators or built-in generators. • Cooking equipment is primarily fueled with propane. 	<ul style="list-style-type: none"> • Sector relies heavily on portable generators for power needs. • A range of gas and diesel generator sizes are used for different events. • Grid power is used when events are in larger venues such as convention centers.
Clean Power Alternatives	<ul style="list-style-type: none"> • Mobile battery power stations are rarely used due to high rental and purchase costs. • If available, grid power will be used. Grid power is typically not available except in certain high-frequency locations. 	<ul style="list-style-type: none"> • Mobile batteries, solar power, and grid power access are actively being pursued but inconsistently implemented. • Growing event-specific sustainability targets are increasing clean power investments.
Future Needs	<ul style="list-style-type: none"> • Lower-cost batteries and increased grid tie-in availability may incentivize further use. • The City of Vancouver is increasing grid power availability as part of the Council motion <i>Eliminating Generators: Greening Vancouver's Film and Food Truck Industries</i>.^{29, 30} 	<ul style="list-style-type: none"> • More grid power access in regularly used locations (e.g., municipal parks and public squares) would benefit events. • Awareness campaign of where and how grid power can be used

²⁹ City of Vancouver, [Public Realm Electrification Program](#), Accessed Jan 12, 2023.

³⁰ City of Vancouver. [Council Memo](#) - Film Industry Clean Energy Policy Framework. May 13, 2022.

<p>Potential Overlap with Film Industry</p>	<ul style="list-style-type: none"> • Developments in battery technology and grid access benefit both industries • Popular parking locations do not tend to overlap with filming locations 	<ul style="list-style-type: none"> • Developments in battery technology and grid access benefit both industries • Certain locations overlap (e.g., city parks), depending on use cycles
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	<p>Landscaping</p>	<p>Construction</p>
<p>Current State</p>	<ul style="list-style-type: none"> • Primary equipment is very portable, directly gas-powered and transported by pickup trucks and vans 	<ul style="list-style-type: none"> • Diesel generators ranging from 100 kW to 3.5 MW (134 to 4,693 hp respectively) are used at large construction sites until grid power is available, depending on the project
<p>Clean Power Alternatives</p>	<ul style="list-style-type: none"> • Battery-powered equipment and electric vehicles capable of recharging equipment are rapidly increasing in availability 	<ul style="list-style-type: none"> • No reported use of electric equipment or hydrogen power • Mobile battery and solar power stations have been used for smaller tool needs
<p>Future Needs</p>	<ul style="list-style-type: none"> • Increased grid power access, including charging stations for EVs and electric equipment 	<ul style="list-style-type: none"> • Electric and hydrogen fuel cell for heavy-duty vehicles and equipment
<p>Potential Overlap with Film Industry</p>	<ul style="list-style-type: none"> • Increased grid power access, EV charging, and electric vehicle developments broadly benefit both industries 	<ul style="list-style-type: none"> • Development in low-emissions heavy-duty vehicles and equipment, as well as mobile battery power stations, benefits both industries

Conclusion and Key Takeaways

The primary overlapping areas for mobile power with the film industry are broad in nature: cleantech development and increased grid power access. Food trucks and events offer the most potential for overlap with filming needs. Both these industries often use similarly sized generators which can be replaced with mobile battery power stations, depending on size and application. Similarly, food trucks and events would also benefit from increased grid power access. The City of Vancouver continues to engage the film, food truck and events industry. However, research and engagement did not identify any specific sites with sufficient or consistent overlap on which to focus efforts. Parking locations do not typically overlap with the film industry due to different use cycles and needs, which means that power kiosks are not likely to be shared. The common barriers are high costs and limited battery availability.

There are fewer overlapping areas between the landscaping, construction, and film industries. The equipment used by landscaping does not overlap with the film industry, although there is some overlap in vehicle types used. Generators used by the construction industry have a much wider range in size than the film industry depending on the project, though smaller generators could be replaced by mobile battery power stations. Both the construction and film industries would broadly benefit from further development in clean-powered heavy-duty vehicles and equipment.

Section 3 – Case Studies: Clean Power and Alternative Fuels

Case studies specific to clean power uses in the film industry and related sectors were identified through a review of grey literature in North America and the UK, as well as key information websites and sources. A total of 14 case studies were reviewed, assessed and summarized in [Appendix 3](#). Key informant interviews were also conducted with clean power vendors, municipal staff members, and representatives from the film industry to supplement case study data (see sources in [Appendix 8](#)). Background information on the conventional diesel alternatives used in the case studies is provided in [Appendix 7](#).

This section summarizes four of the 14 case studies, as well as a synopsis of professional on-production experience from Green Spark Group. The featured case studies include:

1. [Renewable Diesel](#)
2. [Mobile Battery Power Stations](#)
 - a. [Large battery](#)
 - b. [Small batteries](#)
3. [Green Hydrogen Power](#)
4. [Grid Tie-ins](#)

Case Study 1: Renewable Diesel

Intervention:	Renewable Diesel on a Television Series ³¹
Location:	Metro Vancouver, Canada
Period:	16 months, 2020-2021
Displacement:	Diesel fuel used in generators and vehicles via a fuel truck.
Emissions avoided:	Unknown, estimated 70-80% lifecycle emissions reduction

A Vancouver-based television series successfully used renewable diesel (RD) from January 2020-April 2021. A total of 174,196 litres of RD was consumed in both generators and vehicles, displacing conventional diesel. However, the production also consumed 234,740 litres of conventional diesel and 20,461 litres of gasoline in addition to RD. The proportion of generator versus vehicle consumption was not captured.

The price for RD was negotiated with the sole regional supplier to reduce the large cost disparity with conventional diesel. While the price was more competitive, it remained higher than conventional diesel. Total emissions avoided remains unknown as the lifecycle carbon intensity (CI) value for the RD remains unavailable, although the report authors estimated a reduction of 70-80% based on known fuel feedstocks.

³¹ Source: Green Spark Group client dataset.

Key Takeaways

- RD is a transition fuel that can help reduce lifecycle greenhouse gas emissions while continuing to use existing fuel-consuming equipment.
- The pilot successfully showcased that there were no implications to the series production schedule or crew.
- Addressing barriers related to current cost and limited accessibility offers encouraging potential in reducing the industry’s carbon footprint.
- Provincial and regional fuel taxes apply similarly as per conventional diesel despite being recognized federally as a low carbon fuel. Some negotiation may be required for RD prices to be competitive with fossil diesel, but as the regulatory market for alternative fuels in Canada changes and demand increases, costs are anticipated to decrease.

Case Study 2a: Mobile Battery Power Stations - Large battery

Intervention:	VOLTstack 30k - used on a commercial production ³²
Location:	California, U.S.
Period:	9 days in 2022
Displacement:	Large, 750A diesel generator
Emissions avoided:	2.9 tonnes CO2e (gross) 2.5 tonnes CO2e (net) - includes emissions from charging the VOLTstack 30k using a diesel generator

A VOLTstack 30k unit was used every day on a California-based production in a hybrid format with a 750 A diesel generator. The battery unit was used to power the catering and camera trucks 24/7, as well as other batteries and miscellaneous equipment overnight. The unit was recharged daily for 3-4 hours using the diesel generator, reducing generator run time by 84% in the week-long data collection period. The total energy used by the trucks and equipment was equivalent to 6% of a 750A diesel generator.

In addition to the net avoided emissions of 2.5 tonnes CO2e, other benefits included:

- weekly fuel savings of \$1,413
- ease of use
- silent power during filming and overnight
- elimination of onsite carbon emissions and air contaminants when the generator is off.

Case Study 2b: Mobile Battery Power Stations - Small batteries

Intervention:	2x VOLTstack 2k and 2x VOLTstack 5k - used at a broadcast event ³³
Location:	California, U.S.
Period:	Aug 13-19, 2018
Displacement:	Honda 2000 W and 3000 W gas generators
Emissions avoided:	0.6 t CO2e

Portable Electric VOLTstack 2k and 5k units paired with 300 W solar panels were deployed to replace or augment gas generators powering camera and radio frequency towers at a 6-day live

³² Source: Portable Electric.

broadcast golf tournament in California. Two VOLTstack 2k units each paired with one 300W solar panel replaced two Honda 3000W gas generators at two radio frequency mini sites, avoiding 91 L (24 gallons) of fuel and 191 kg (422 lb) CO₂e. A generator was occasionally used to top up battery power when solar was insufficient due to overcast conditions.

Additionally, VOLTstack 5k units were deployed for the two camera towers, one with a 300W solar panel, and one without any solar. One camera tower drew 615W on average, and the other 350W. Each camera tower was powered by a VOLTstack 5k for 8 to 14 hours respectively. Without additional solar power, a generator was used to recharge the VOLTstack 5k units for about 2 hours per day, creating a hybrid system that reduced generator runtime by more than 75%. In total, 174 L (46 gallons) of fuel and 359 kg (792 lb) CO₂e were avoided. Collectively, the 2k and 5k mobile batteries avoided using 265 L (70 gallons) of fuel and 0.6 tonnes CO₂e).



*VOLTstack 5k.
Credit: Portable Electric*

Key Takeaways

- Productions typically use generators that provide more power than needed, resulting in inefficiencies, air contaminants, and GHG emissions.
- Mobile battery power stations can replace comparably sized generators completely, notably for film production purposes including catering and work trucks.
- Mobile battery power stations can reduce generator runtime when used in a hybridised format with generators.
- Smaller mobile batteries can be recharged with solar power, making the power system renewable and self-sufficient in favourable weather conditions.

³³ Source: Portable Electric.

Case Study 3: Green Hydrogen Power

Intervention:	Green Hydrogen - GeoPura™ HPU ³⁴
Location:	United Kingdom
Period:	2021-2022, multiple seasons of 2-3-week broadcasts
Displacement:	Diesel internal combustion engines (generators)
Emissions avoided:	13.7 t CO ₂ e, 195 kg NO _x , 107 kg CO, and 7.6 kg PM

Green hydrogen comes from renewable sources, and hydrogen fuel cells are entirely zero-emissions, with water as the only by-product. BBC's Natural History Unit first deployed green hydrogen power in 2021 to fully replace diesel generators for a 60-minute live broadcast episode. The Hydrogen Power Unit (HPU) is a stationary unit delivered to site and remains in that location. To develop confidence in the HPU during the pilot project, the team slowly drip-fed hydrogen power into the power supply until one day, they switched off their generator and used only green hydrogen power. They continued to develop their process for future broadcasts to increase crew experience and confidence, powering all twelve live broadcasts over a 3-week period using mainly hydrogen.



Image: Geopura HPU, Winterwatch 2022, BBC. Image credit: Geopura.

In March 2022, the hydrogen unit was used again as the sole power source on location for filming, including catering, lights, cameras, and other uses. Since the HPU was used in different applications with each season of broadcasting, the most recent data for Winterwatch 2022 were made available. Over the week of set-up and two weeks of filming, the HPU:

- generated 14,235 kWh of electricity, and saved:
 - 5,215 litres of diesel,
 - 195 kg of nitrogen oxides (NO_x),
 - 107 kg of carbon monoxide (CO),
 - 7.6 kg of particulate matter (PM) and
 - 13,669 kg CO₂e (13.7 t CO₂e).

³⁴ Source: BBC Natural History Unit representatives.

Key Takeaways

- Hydrogen fuel cells were proven to be capable of providing continuous, reliable, zero-emissions power to productions, and film equipment providers are looking into providing hydrogen solutions in the future.
- There is currently no availability in Canada or anticipated in the near term. Both Federal and Provincial governments in Canada, including BC, are elaborating and deploying a hydrogen strategy in alignment with becoming net-zero by 2050.³⁵
- Hydrogen fuel cells used in the UK are most useful when productions are stationary for an extended period (e.g., filming at a soundstage or at a location), due to the equipment size and need to transport fuel.
- Should HPUs become available in Metro Vancouver, the best potential application would be at facilities for supplemental power needs, where grid power cannot meet the demand (see [Section 1 – Generator Use at Facilities](#)). This is being piloted by UK productions.

Case Study 4: Grid Tie-ins

Intervention:	Grid tie-in ³⁶
Location:	Vancouver Art Gallery (VAG), Canada
Period:	2021-2022
Displacement:	Diesel and gas generators, various sizes
Emissions avoided:	Estimated 74 t CO2e

The Vancouver Art Gallery (VAG) has two 400A, five 200A, and two 100A grid tie-ins (all exterior), in addition to one interior 200A grid tie-in. All 10 grid-ties are available to productions for filming needs. Since 2020, using grid tie-ins at VAG has been a requirement. This has resulted in an almost complete elimination of generators at site. For example, of the 159 filming days at the VAG in 2021, only 2 days of production required a generator to make up for a grid tie-in that was already in use. Previous years showed much more frequent generator use on site.

The change met with little resistance and immediately eliminated generators. No challenges or training needs were reported with using the tie-ins as they use cam-lock systems familiar to production electricians. The only adjustment was establishing a notification process with site managers to ensure access to the grid-ties. The cost to connect to the grid ties is below the market rate for the comparable amount of fuel that would be consumed. Each tie-in day is estimated to help avoid the use of two 1400 A diesel generators running at 25% load capacity for 14 hours, or about 174 litres of diesel avoided per day according to a recent study.³⁷ This is equivalent to about 27,666 litres avoided in 2021, which is an estimated 74.7 t CO2e avoided.³⁸

Notably, the study noted above may be an under-representation of fuel use and related emissions as these results reflect Tier 3 generators from a single manufacturer and their age is

³⁵ [The Hydrogen Strategy | Government of Canada](#) and [BC Hydrogen Strategy | Province of British Columbia](#).

³⁶ Source: Location Fixers.

³⁷ A case study from Valid Manufacturing found that a 168 kW Tier 3 generator consumes an average of 86.91 litres of diesel per day. See Valid Manufacturing, [How to Power your Film Set Efficiently](#), July 13, 2022.

³⁸ According to values from the [2020 BC Best Practices Methodology for Quantifying GHG Emissions](#), 1 litre of diesel emits 2.70 kg CO2e/L.

unknown. Green Spark Group's professional experience, as well as anecdotal data from generator operators interviewed for this report, have estimated consumption levels of up 1400A Tier 3 generators as high as 16.2L/hr at 25% capacity. Using this consumption rate, in contrast with the estimates in the previous paragraph, this is equivalent to 72,122 litres, or an estimated 193.7 t CO₂e of avoided emissions in 2021.

As at September 2022, grid tie-ins at the VAG were used a total of 107 days for 2022, and generators used for 0 (zero) days. Assuming each tie-in day eliminates two 1400 A diesel generators as for 2021, grid tie-ins at the VAG have already avoided about 50.3 t CO₂e in the first 9 months of 2022 using Valid Manufacturing's case study data. Moreover, all other harmful emissions and particulates associated with diesel generators were eliminated.



Film power kiosk at the Vancouver Art Gallery. Credit: City of Vancouver

Key Takeaways

- Grid tie-ins can eliminate the need for generators when placed strategically where productions can use them, and when they have sufficient power.
- Costs for tying into and using grid power in Vancouver and other regions are competitive compared to generator rental and fuelling fees.
- Permitting requirements paired with available grid tie-in infrastructure can successfully eliminate generators with a positive response from productions, helping to meet both industry and municipal emissions reduction goals.

Conclusion

The film industry is known to innovate and explore creative solutions. The case studies above, as well as those summarised in [Appendix 3](#), demonstrate that alternative power and clean tech solutions are actively being piloted, tested, and adopted throughout the industry across all jurisdictions. These are encouraging developments in the pursuit of decarbonising the energy needs for productions. Alternative and clean power show promise, and trained crews have successfully adapted. However, as cost and availability continue to be barriers to wide adoption, in parallel with a production's vast, complex, and variable power needs, no single solution or silver bullet is emerging.

Section 4 – Frequent Filming Locations in Metro Vancouver

The following section provides an overview and analysis of high frequency filming locations within Metro Vancouver. Hot spots offer a strong rationale to prioritise clean power investment in these locations, thereby ensuring ongoing filming activity while contributing to improved local air quality as well as reduced GHG emissions for the industry, local municipalities, and the Metro Vancouver region. The findings herein were derived through:

- Engagement with Creative BC representatives to gather regional film permitting data, including the number of filming days in Metro Vancouver jurisdictions;
- Review and analysis of Creative BC's [Clean Energy Toolkit and Resource Maps](#) which provide current and accurate site specific data on generator use and clean power technology needs;
- Stakeholder interviews and correspondence with Creative BC, and the top 5 Metro Vancouver member jurisdictions revealed as high frequency locations (Table 2).

A total of 6,102 filming days were reported across Metro Vancouver jurisdictions in 2021 according to Creative BC (see [Appendix 4](#) for details). This includes 5,416 days filmed on location and 686 filmed in a studio facility.³⁹ Importantly, the number of filming days in a studio facility is a conservative value as many jurisdictions do not track filming days in a studio facility. On location filming days are tracked through the local permit application process.

Top five filming jurisdictions across Metro Vancouver are noted in Table 2 (next page) based on the number of filming days spent *on location* in 2021, representing almost 69% of all location filming within Metro Vancouver that year. An important gap in this data is the provincially owned Riverview Hospital site in Coquitlam. Riverview is the most filmed location in Canada, culminating in 2018 with over 200 filming contracts, yet relies entirely on mobile power.⁴⁰

Top Filming Sites by Jurisdiction

Within the top five filming jurisdictions, 19 hot spot filming and circus parking locations were provided as targets of opportunity for clean power development, excluding the Township of Langley due to data unavailability (see Table 3, page 31).⁴¹ Total filming days at top sites in 2021 ranged from approximately 25 to 125 days of use. Four locations saw over 75 filming days. As the VAG site case study demonstrates ([Section 3, Case Study 4](#)), available power kiosks in high-use locations can significantly reduce or eliminate generator use by film productions. VAG site data was excluded despite its popularity as a filming location (159 days in 2021) as power kiosks are currently available and widely used. At minimum, a power kiosk would help to eliminate the need for a circus generator, thereby avoiding 0.47 - 0.69 tCO₂e of emissions per day.

³⁹ Jurisdictions also include Metro Vancouver Regional Parks, Vancouver Parks, and UBC (under Electoral Area A).

⁴⁰ City of Coquitlam, [Filming Locations](#)

⁴¹ Township of Langley were not available to confirm estimates or key sites.

Table 2: Number of 2021 location filming days in top Metro Vancouver filming jurisdictions.

	Jurisdiction	Number of location filming days in 2021 ⁴²
1	Township of Langley*	1,724 (32%)
2	City of Vancouver	972 (18%)
3	City of Surrey	435 (8%)
4	City of Maple Ridge	355 (6.5%)
5	Metro Vancouver Regional Parks	244 (4.5%)
Total Top 5		3,730 (69%)

*Data was gathered by Creative BC. Staff from the Township of Langley were not available to confirm estimates. This figure is high as the data likely includes exterior filming areas and temporary stages at facilities at Martini Studios, though this remains unconfirmed.

Sites were cross-referenced with Creative BC’s [Grid Power Access](#) and [Generator Parking Locations](#) maps (Table 3, next page) to assess the number of generators per site disclosed. However, availability and quality of data were limited as these are not consistently tracked, nor is it a required reporting commitment. City of Vancouver data on generator parking was the most extensive as its Film Office has a policy to actively follow up with productions to report generator locations (See [Section 1, Film Permit Requirements](#)).

Site-specific assessments have been initiated for power kiosk development. Of the 19 sites identified, one site in Maple Ridge has existing grid power available, and seven are on the Grid Power Access map’s “Wishlist” for power kiosk development as at September 2022 (see Table 3). One site has been removed from the Wishlist as the City of Vancouver recently launched the opening of new power kiosks at the Concord Pacific Lot in April 2023. As the City of Vancouver completes additional installations in high-use areas film crews will be able to find a power kiosk within a 10-minute drive of most sets.⁴³



Launch event for the new power kiosks at the Concord Pacific Lot, 88 Pacific Boulevard, City of Vancouver (April 13, 2023). Credit: Andrew Robinson, Green Spark Group

⁴² The numbers of filming days for each jurisdiction were collected by Creative BC.

⁴³ [Vancouver launches clean energy initiative to provide renewable power to film sets](#), Vancouver Economic Commission.

Table 3: High-Use locations in the Top 5 Metro Vancouver filming jurisdictions (2021).*

Location	Total 2021 Location Filming Days*	Total Generators Reported (Since 2019)**	Grid Power Access Map Designation
Township of Langley⁴⁴			
Not Available	1,724	4	N/A
City of Vancouver			
Concord Pacific Lot, 88 Pacific Boulevard	75+	110	Power Kiosk Completed and launched April 2023
Victory Square, 200 West Hastings	50-75	56	Wishlist
Shaughnessy Park	25-50	38	Wishlist (specifically Hycroft Manor)
Hastings & Thurlow	25-50	28	-
W Cordova St. & Carrall St.	25-50	21	Wishlist
1300 The Crescent	25-50	17	-
Oxford Properties, Burrard at W. Cordova	25-50	12	Wishlist
37th Ave adjacent to Van Dusen	<25	1	-
City of Surrey			
Cloverdale Fairgrounds, 17607-17905 62 Ave, Surrey, BC	125	2	Wishlist (Cloverdale Rodeo)
176 St & 57 Avenue	66	0	-
10665 University Drive	60	0	Wishlist
City of Maple Ridge			
23588 Jim Robson Way	~100	0	-
22155 Lougheed Highway	60-70	5	-
11995 Haney Place	60-70	5	Existing grid tie-in, reportedly underused
Metro Vancouver Regional Parks			
Capilano River	57	4	Wishlist
Belcarra	43	0	-
Lower Seymour Conservation Reserve	29	5	-
Derby Reach	25	0	-
Widgeon Marsh Conservation Reserve	23	4	-

*As reported by municipalities to Creative BC. Data excludes the provincially-owned Riverview Hospital (Coquitlam) which remains the [most filmed location](#) site in Canada. The City of Vancouver does not have site-specific numbers but adopts a distribution of sites with 25/50/75+ filming days with most sites being in the 25-50 range. City of Vancouver site estimates have been distributed by top generator parking locations based on these numbers.

**According to the [Generator Parking Locations Map](#), as at December 2022.

⁴⁴ No location information was available from the Township of Langley via Creative BC, email, or interview.

Clean Power Use on Production

Generator parking and clean energy access data from 2019-2020 was initially provided to Creative BC from 2019-2020 by the City of Vancouver. Productions subsequently began reporting through Creative BC's [Generator Parking Locations Map](#) in 2020. Productions in the Lower Mainland are currently encouraged, though not mandated, to report clean power usage through this map tool.

According to Creative BC's data backup, 372 clean power sources were reportedly used between October 2020 and April 2022. Electric batteries comprised (40%) of these sources and 225 (60%) were tie-ins. Tie-in locations were primarily in Vancouver (200, or 89%), Burnaby (13, or 6%), and the Township of Langley (12, or 5%). Higher numbers in the City of Vancouver are likely attributable to various factors including the higher reporting rate with the city's Film Permit Office, the greater availability of grid tie-ins, and high number of location filming days.

The number of reported power sources used since 2019 is summarized in Table 4. However, available data does reveal any meaningful cross-jurisdictional conclusions. The large disparity between from the City of Vancouver and other municipalities highlights an important data gap. Closing this data gap would further contribute to a more coherent decision making and trend analysis across Metro Vancouver filming jurisdictions, and potentially contribute to regional alignment on key performance indicators. See [Section 7 - Data Collection in Member Jurisdictions](#).

Table 4: Reported power sources in the top 5 filming jurisdictions, as at September 2022.

Top Metro Vancouver Film Jurisdictions (In 2021)	Number of Generators Reported (Since 2019)	Number of Battery Power Stations Reported (Since 2019)	Number of Grid Power Access Points Available (As at Sep 2022)	Number of Grid Tie-ins Reported (Since Oct 2020)
Township of Langley	19	0	7	12
City of Vancouver	4140	100	78	200
City of Surrey	15	0	3	0
City of Maple Ridge	19	1	4	0
Metro Vancouver Regional Parks	4	0	0	0

Generator Use on Studio Blocks

Generator usage and grid power access points were also examined at studio facilities across Metro Vancouver. According to available data, 12 out of 33 facilities had generators parked within their block or at a nearby lot (Table 5). Notably, generators were found on the same block as two of the five purpose-built facilities, and 10 out of 29 converted facilities (see [Appendix 4](#) for a complete list of converted versus purpose-built studios in Metro Vancouver). Due to limitations in the filtering abilities on MapMe, these data contain estimates based on a

methodology using visual proximity. This finding underscores the fact that generators are often used on studio facility lots across the region. Further, it is likely under-reported as both professional experience and research findings indicate that generators are almost always used on studio facility lots ([Section 1 – Generator Use at Facilities](#)). See [Section 5](#) for emissions reduction potential using mobile power on location and on studio blocks.

Table 5: Summary of generators and clean power used around studio facilities.

Stage Type	Number of Facilities ⁴⁵	Number of Generator parking locations ⁴⁶ (Reported since 2019)	Number of Clean Power usage locations ³⁷ (Reported since 2019)	Number of Clean Power access locations ⁴⁷ (As at Sep 2022)
Purpose-built	5	23	5	1
Converted	28	40	1	1
PNE*	1	83	17	40

*The Pacific National Exhibition (PNE) is listed as a converted stage facility on Creative BC’s website; however, the high number of clean power access points and generators at such a large filming location skewed results so the PNE was separated from other converted stages.



The Urban Power Source battery generator is the largest available in the Metro Vancouver region. Credit: MBSE Canada.

⁴⁵ Source: [Stages + Studio Facilities - Creative BC](#)

⁴⁶ Source: As reported by productions to the [MapMe Generator Parking Locations Map](#)

⁴⁷ Source: As made available by Reel Green on the [MapMe Grid Power Access Map](#)

Section 5 – Estimated Emissions Reduction Potential

The following section assesses emissions reduction potential from using clean power sources on a medium sized production as most productions filming in Metro Vancouver fall within the medium to large budget range (\$20 - \$70 million USD).⁴⁸

Daily emissions reduction estimates

This scenario was developed using a case study of a medium production shooting in Metro Vancouver over Summer 2022.⁴⁹ The production used seven different generators, though these did not all operate at the same time, nor for the same length (see Table 6, Hours/day).

Table 6: Example Medium Production using diesel generators, 2022.

Application	Phase A	Phase B	Phase C	Total Amps	Hours/day	kW	kWh	Diesel (L)	L/kWh	EF (tCO ₂ e/L)	tCO ₂ e/day
Typical Circus	100	120	80	300	14	36	504	256.0	0.51	2.70E-03	0.69
Catering	25	5	12	42	8	5	40	98.8	2.45	2.70E-03	0.27
Big Night Exterior	180	320	220	720	8	86	691	240.0	0.35	2.70E-03	0.65
Day Exterior with HMI	90	90	45	225	7	27	189	115.2	0.61	2.70E-03	0.31
Work Trucks	40	10	2	52	7	6	44	87.9	2.01	2.70E-03	0.24
Ritter Fan - set	63	26	26	115	7	14	97	97.5	1.01	2.70E-03	0.26
Craft & COVID Testing	0	42	10	52	13	6	81	163.3	2.01	2.70E-03	0.44
Total GHG emissions											2.86

Using this production as a baseline comparator, four emission reduction scenarios were explored: grid tie-in, renewable diesel, battery power station option and a mixed scenario using grid-tie and renewable diesel. Emissions factors used to estimate the emissions reduction potential were:

- Diesel: 2.70E-03 tCO₂e/L⁵⁰
- Biodiesel (B100): 1.22E-04 tCO₂e/L⁵¹
- Renewable diesel (R100): 1.22E-04 tCO₂e/L⁵²
- BC Hydro: 9.70E-06 tCO₂e/kWh⁵³
- Battery efficiency (li-ion): 0.8⁵⁴

⁴⁸ Sustainable Production Alliance. [Carbon Emissions of Film and Television Production](#), March 2021.

⁴⁹ The case study was provided by a local generator operator. See [Appendix 5 - Sources](#) for more information.

⁵⁰ Source Table 1: [2020 B.C Best Practices Methodology for Quantifying Greenhouse Gas Emissions](#)

⁵¹ Source Table 1 above + Table 19: [2020 B.C Best Practices Methodology for Quantifying Greenhouse Gas Emissions](#)

⁵² Source Table 1 above + Table 19: [2020 B.C Best Practices Methodology for Quantifying Greenhouse Gas Emissions](#)

⁵³ [Electricity emission intensity factors for grid-connected entities - Province of British Columbia](#)

Generator power related activities on the medium production baseline scenario would generate up to 2.86 tCO₂e/day. Using this scenario and assuming no barriers to access or use to alternative fuels or clean power, emissions reduction potential was estimated in Table 7.

Table 7: Daily emissions reduction potential using alternative fuels or clean power (Medium budget production)

Emissions Scenario	Total Emissions/day	Emissions Reduction Potential	Notes
Baseline Medium Production	2.86 tCO ₂ e	n/a	Standard diesel generator scenario
Grid-tie ins/ Power Kiosks	0.016 tCO ₂ e	99%, as well as NO _x and PM	Where all generators were displaced by using grid tie-ins
Renewable diesel (RD)	0.129 tCO ₂ e	95%	Where all generators consumed RD, total GHG emissions would decrease, other emissions would continue to be present
Battery power stations	0.020 tCO ₂ e	99%, as well as NO _x and PM	Where all generators were replaced by battery packs and recharged on the local grid. current battery power options on the market cannot currently eliminate all power needs for a production over an active 14-hour shooting day. This scenario may be possible with a greater number of battery power options than the number of initial generators to be displaced.
Mixed Scenario	0.103 tCO ₂ e	96%, as well as NO _x and PM	This scenario replaced the circus generator with a grid tie-in and the remainder of generators were fueled with RD.

The site and production specific GHG reduction potential will vary based on the number of filming days and energy consumption needs of the production. Calculations and information for the scenarios above is included in [Appendix 5](#).

Emissions reduction potential at studio facilities

A total of 686 filming days at studio facilities were reported in 2021.⁵⁵ Based on this figure, eliminating diesel generator use at these facilities would reduce emissions throughout Metro Vancouver by a minimum of 322 - 473 mtCO₂e per year (depending on whether clean power or alternative fuels were used).

Importantly, most Metro Vancouver jurisdictions do not report total filming days when productions are shooting in studio facilities, as opposed to location filming (see [Section 4 - Frequent Filming Locations in Metro Vancouver](#)). Given that productions almost always use one

⁵⁴ [9.2. Battery storage | EME 812: Utility Solar Power and Concentration](#)

⁵⁵ Reported to Creative BC for 2021 filming days.

or more generators to power circus and work trucks when parked there, the emissions reduction potential focused on studio facilities is therefore anticipated to be much higher. Under a scenario where Metro Vancouver's 33 studio facilities were utilised for principal filming activity 50% of the time, this would represent 5,164 filming days⁵⁶. Availability and access to this data would be beneficial to appropriately assess the scale of fuel consumption and emissions reduction possibilities (see [Section 1 – Generator Use at Facilities](#)).

Emissions reduction potential of new generator technology

Finally, Tier 4 (800 A) and Tier 4-hybrid (800 A) generators have recently become available on the commercial market. As at April 2023, these continue to be assessed and tested by at least two local equipment suppliers in Metro Vancouver. Tier 4 generators are modern and operate more efficiently as compared to Tier 3 generators, and the available models at 800 amperes offer a generator size more in line with actual power consumption requirements for film. The Tier-4 hybrid offers the same, with the added benefit of drawing power from the battery as opposed to the generator for lower demand scenarios. As such, fuel consumption and emissions reduction potential for these generators were assessed using available information from Valid Manufacturing.⁵⁷

Under a scenario where a generator operated over 11 hours and provided 171 kWh of power, the Tier 4 generators would reduce GHG by approximately 7% as compared to Tier 3 (Table 8). In contrast, the T4 hybrid system could potentially reduce GHG emissions by up to 45%. Pending the viability of these systems for the film industry, until the barriers of wide grid access or affordability of battery power are adequately addressed, Tier 4 and Tier 4 Hybrid generators may offer a near term opportunity to reduce production related emissions.

Table 8: Fuel consumption and emissions reduction potential for T4 and T4 Hybrid systems

Generator Type	kWh	kW	hr/day	Diesel (Litres/day)	L/kWh	avg load	tCO2e/day	Emissions reduction
T3 (168 kW, 225.3 hp)	171	15.6	11	86.9	0.508	9.3%	2.35E-01	n/a
T4 (100 kW, 134.1 hp)	171	15.6	11	81.1	0.474	15.6%	2.19E-01	7%
T4 Hybrid	171	15.6	11	47.8	0.280	n/a	1.29E-01	45%

⁵⁶ 365 days/year – 52 Sundays * 33 studios * 50% = 5,164 days

⁵⁷ Valid Manufacturing. [How to Power your Film Set Efficiently](#). July 13, 2022.

Section 6 – Landscape Scan: Clean Power Regulatory or Policy Mechanisms

Film Funds and Organisations

A landscape scan of fifteen film and television funds as well as film commissions based in North America and Europe was completed in September 2022. This exercise served to identify the size and scale of existing and proposed industry-specific policy efforts or initiatives related to clean power. The landscape scan summary below is also provided in greater detail in [Appendix 6](#).

- A total of four organisations linked sustainability conditions to their permit and/or funding processes. None of these conditions specifically target emissions reduction initiatives through clean energy.⁵⁸
- Nine organisations provided carbon calculator resources to productions. Three currently require carbon footprint calculation by productions to incentivize emissions reduction through clean power.
- A range of organisations provide financial incentives in a variety of forms, such as funding bonuses for sustainability or covering extra sustainability-related costs. Currently, five organisations provide funding incentives, and one organisation is exploring future funding incentive opportunities.
- Six organisations also provide information and/or clean energy resources specifically for productions. Three partnership organisations, the Centre national du cinéma et de l'image animée (CNC); Film London with British Film Institute (BFI); and British Academy of Film and Television Arts (BAFTA) with albert, provide targeted support for sustainability efforts at studios/soundstage facilities, including cleaner energy.
- Four organisations, Creative BC, Ontario Creates, Film London/BFI, and Netherlands Film Fund, provide some form of mapping resources for productions to help them access grid power.
- BAFTA/albert provides a Creative Energy scheme for UK productions to source renewable energy which had over 100 members in 2021 who collectively saved 4,131 t CO₂e.⁵⁹

Regional and Local Government Jurisdictions

Three jurisdictions interviewed for this project currently provide incentives for clean power: the City of Vancouver, City of Surrey and the Region of Metro Vancouver's Regional Parks.

⁵⁸ Note: Since this scan was completed, the Canadian Media Fund in 2023 has included measures for carbon accounting for productions beyond a [specific budget threshold](#).

⁵⁹ [ALBERT Annual Review 2021](#). Creating a Sustainable Future.

In 2019, Vancouver City Council passed a motion to eliminate the use of generators for filming and food trucks in Vancouver.⁶⁰ Since August 2020, the City of Vancouver has provided a 50% film permit rebate (about \$500) to productions who can demonstrate that they have eliminated one generator in favour of clean power. In 2021, approximately 30% of permitted productions in Vancouver received the rebate. As the City of Vancouver approaches its goal of eliminating all generators, this threshold will be revised as more productions successfully obtain the rebate.⁶¹

As at April 2023, the new policy framework from the City of Vancouver outlines how the incentive program and regulations will shift as more infrastructure becomes available to continue rewarding early-adopters of clean energy. The policy framework considers fee incentives, infrastructure investment, and regulatory requirements over a 4-phase approach, with Phase 2 beginning in 2023.⁶² After 2030, the incentive program will phase out and the City of Vancouver will require productions to use clean power for all sources, with some exemptions if necessary.

The City of Surrey also provides \$500 off location fees for productions that eliminate a large-scale diesel generator. This incentive applies specifically when by tying into the City's available house power while filming at a civic location (e.g., swimming pool).⁶³ Data on the number of productions receiving the rebate was unavailable.

Metro Vancouver introduced a clean energy incentive in January 2022, also a 50% permit rebate (\$500) for up to 2 days when productions can demonstrate they have replaced at least one 400A (or greater) generator with clean power. Only one production received the rebate in 2022. The lower adoption rate may be attributable to communications challenges to build awareness with productions (see [Section 7 - Metro Vancouver Regional Parks Permit Application and Clean Energy Discount](#)).

Feedback from studios and producers about clean energy incentives has been largely positive. One studio representative explained that the City of Vancouver's rebate helped many of their productions break even or save money on the cost of renting mobile batteries instead of generators, and reflected that in neighbouring jurisdictions without a rebate, there were limited opportunities for cost savings. One challenge that smaller jurisdictions with lower permit fees face is that a 50% rebate is not feasible for their operations or is perceived to be a negligible cost savings for productions and thus reduces the incentive. However, the City of Vancouver incentive is arguably low relative to broader production spend, yet it has been sought by productions.

Key municipalities that are developing clean energy infrastructure in the form of power kiosks for the film industry are the City of Vancouver, Toronto, and London (UK). Toronto and London opened their first kiosks before the end of 2022. The City of Vancouver will install a further 12-15 power kiosks by 2030, and the City of Toronto will install 4 by the end of 2023,⁶⁴ with more

⁶⁰ City of Vancouver Council Meeting Motion, [Eliminating Generators: Greening Vancouver's Film and Food Truck Industries](#), July 23, 2019

⁶¹ [Eliminating Generators Greening Vancouver's Film and Food Truck Industries \(RTS 13364\)](#)

⁶² City of Vancouver. [Council Memo - RTS 13364 - Film Industry Clean Energy Policy Framework](#). May 13, 2022. The most recent framework was presented at the Reel Green Clean Energy Battery Workshop on April 2, 2023, by Geoff Teoli, Vancouver Film Commissioner.

⁶³ City of Surrey, [Filming in Surrey](#)

⁶⁴ [Toronto's screen production industry sets record with more than \\$2.5 billion in direct spending in 2021](#).

potentially following. In addition, the City of Surrey is engaging with BC Hydro and Creative BC to install a power kiosk in a heavily used production lot in the coming years. Toronto and London are collecting consumption data as part of the pilot initiative, but for Vancouver the focus is installing the kiosks as soon as possible.

In 2019, the City of Vancouver required that all productions filming at the Vancouver Art Gallery must use grid tie-ins instead of generators unless absolutely necessary, which decreased generator usage at that site effectively to zero. They are considering similar requirements at other sites where grid power is available. The City of Surrey requires all productions to use grid power, when and where this is available on municipal property, which has been successful in largely eliminating generators near City Hall for the past 3 years. The City of Toronto and London are also considering future clean power usage mandates.

Requirements by Soundstage Facilities

Four studio facility representatives, accounting for the majority of facilities in Metro Vancouver, were surveyed to assess the number and type of clean energy policies or initiatives used on their respective sites. Results indicate that two facilities currently have formal policies related to clean energy (see [Appendix 6B](#)). Martini Studios is the only facility that has mandated in their production agreements that the studio facility is to remain diesel generator free.

There is a stark divide between owned facilities versus leased facilities. Owned facilities are purpose-built and have the autonomy to invest in energy upgrades, whereas leased facilities are often converted and do not see a business case in investing in energy upgrades while demand for available filming space remains high. Representatives from purpose-built facilities described policies that would further contribute to reducing emissions from generators, such as remote consumption monitoring, camlock/grid-tie installation for on-lot power, and mandating for the facility lot to be generator-free. One respondent noted the potential role for Metro Vancouver to discourage generator use on facility lots and provide support for facility power upgrades.

Some facilities have mandated vendor agreements, although these typically focus on waste and water management practices as opposed to clean energy.

Requirements by Motion Picture Industry Members

There are no clean energy requirements for productions from major production studios at this time. Studios are encouraging decarbonisation efforts on production and are developing guidance documents to this effect, however specific targets and solutions are not mandated. According to interviews with studio representatives and producers, most are exploring the use of alternative fuels and clean technologies to reduce the carbon footprints of their respective productions.

Clean energy incentives in filming jurisdictions are looked upon favourably and actively pursued by industry representatives (see above, [Requirements by Local Government Jurisdictions](#)). However, the systemic lack of available studio space across the industry is currently taking precedence in decision making over sustainability initiatives.

Section 7 – Recommendations for Clean Power Solutions

Recommendations for advancing and promoting clean power technology solutions and infrastructure throughout the region of Metro Vancouver are provided for consideration herein. These recommendations are based on the research findings summarised in this report. They relate to distinct stakeholders to varying degrees, including Metro Vancouver, its member jurisdictions, BC Hydro, Creative BC, as well as other orders of government given the range of opportunities and interested parties needed to achieve meaningful emissions reductions (Table 9). Further, these recommendations also acknowledge the broad convening and communication role that Metro Vancouver can play with various stakeholder groups. Recommendations are summarized into:

- Short term: Technology and mechanisms available immediately for use in next 1-2 years;
- Intermediate: Technology and mechanisms likely available in the next 3-5 years.

Enhance the Regulatory Environment

Whereas mandates and bans can be considered untenable by productions, regulations and permit conditions requiring the use of grid power when available have proven to be successful. Still, no regional framework for clean energy filming currently exists within Metro Vancouver. In the absence of a regional clean energy filming standard, production companies have limited, inconsistent or mismatched prospects to pursue clean energy solutions and opportunities.

Intermediate Term

Key Recommendation: Establish a Clean Energy Filming Standard for the greater Metro Vancouver region. Metro Vancouver and its member jurisdictions to collaborate in setting a regional standard and roadmap to achieve 100% clean energy for all filming, including:

- All soundstage facilities (purpose-built and converted) as well as other facilities declared for filming purposes to provide sufficient grid power. Grid power should be available for all production activities; filming inside the facility and for support areas (e.g., parking, trailers)
 - Maximize existing and potential BC Hydro service at sites
 - Maximize on site battery storage for mobile battery power stations and to store renewable power generated on site.
 - For additional energy needs, facilities should prioritize generating electricity from hydrogen, renewable natural gas, or renewable diesel, when necessary, with a plan to transition away from carbon-emitting fuels.
- Access to grid power and/or clean energy opportunities to be pursued as the initial default power option in all locations where film permits are issued. Exceptions can be applied if verified by Metro Vancouver's film liaison to be necessary.

- Explore regulatory options to disincentivize the use of generators in studio backlots or parking lots. Examples include building permit approvals, and business license renewals, a fine per facility should diesel generators be used at studio and backlot facilities.

Recommendation: Metro Vancouver to consider revising [NRDEE](#)⁶⁵ and create a separate fine structure for the film industry that will accelerate the transition to Tier 4 generators.

Recommendation: Metro Vancouver to phase-out and ban the use of Tier 0, Tier 1 and Tier 2 generators in the region for filming. This can be achieved if all units have telematics.

Recommendation: Metro Vancouver to advocate for the execution of a clean energy filming standard at provincially owned sites within the region (e.g. Riverview, one of the most active filming locations in North America).

Short Term

Recommendation: Metro Vancouver to engage all municipal jurisdictions and assess existing film permit constraints and opportunities with respect to clean energy. Collaborate to help determine a pathway forward to align or complement regionally with the City of Vancouver's Film Industry Clean Energy Policy Framework⁶⁶. This framework aims to phase out the use of diesel generators by 2030 via a phased approach that includes fee incentives, investment in clean energy infrastructure, and regulatory requirements.

Recommendation: Metro Vancouver and its membership to review recommendations herein and determine which are appropriate for regulatory pursuit.



The Vancouver Art Gallery is a popular film location power exclusively by grid ties. Credit: VEC 2023

⁶⁵ Read the full bylaw, Non-Road Diesel Engine Emissions [here](#).

⁶⁶ City of Vancouver. [Council Memo - RTS 13364 - Film Industry Clean Energy Policy Framework](#). May 13, 2022. The most recent framework was presented at the Reel Green Clean Energy Battery Workshop on April 2, 2023, by Geoff Teoli, Vancouver Film Commissioner.

Table 9: Summary of Recommendations and related Stakeholder Group

Stakeholder Group	Metro Vancouver	Member Municipalities	Creative BC	BC Hydro	Government of BC
Enhance the Regulatory Environment					
Establish a Clean Energy Filming Standard for Metro Vancouver (Key recommendation)	X	X			X
All studio facilities to provide adequate clean power for all production needs	X	X		X	
Productions use grid power as default in all locations where permits are issued	X	X			
Explore regulatory options to disincentivize the use of generators in studio backlots or parking lots	X	X			
Revise NRDEE and create a separate structure for the film industry to accelerate the transition to Tier 4 generators	X				
Ban use of Tiers 0-2 generators by the film industry	X	X			
Advocate for the execution of a clean energy filming standard at provincially owned sites	X				X
Align film permit processes with the City of Vancouver's Clean Energy Framework across member jurisdictions	X	X			
Assess recommendations herein for regulatory potential	X	X			X
Align Clean Energy Incentives					
Consolidate various municipal film permit processes under a single office and fee structure	X	X			
Develop consistent regional clean energy incentives	X	X			

Stakeholder Group	Metro Vancouver	Member Municipalities	Creative BC	BC Hydro	Government of BC
Improve Data Collection					
Develop consistent data collection methodology across jurisdictions	X	X	X		
Collect emissions related data during filming permit processes	X	X	X		
Collaborate to compile and utilize regional data that is collected	X	X	X	X	X
Accelerate Infrastructure Development and Use					
Create a plan to rapidly assess and install grid power access at popular filming and basecamp/circus parking locations	X	X	X	X	
Clearly communicate grid power access locations and use requirements to productions during the permit process	X	X	X		
Vet existing and potential future grid power access locations at popular filming and basecamp/circus parking locations within Metro Vancouver's Regional Parks	X		X		
Communicate and apply for BC Hydro's power kiosk infrastructure development incentives	X	X	X	X	
Incorporate adequate power availability confirmation into building permits and business licences for studio owners		X			
Where existing capital development projects are planned or underway, incorporate grid power access for filming activities	X	X		X	X

Accelerate Power Service Upgrades at Studio Facilities					
Identify best opportunities to upgrade power service in areas with studio facilities and high location filming activity	X	X	X	X	
Coordinate the installation of additional EV charging hubs near studio facilities as well as popular filming locations	X	X	X	X	
Amplify Metro Vancouver Regional Parks' Permit Application and Clean Energy Discount					
Share details about the Clean Energy Discount with productions through the film permitting process	X				
Collect clean power data from productions via the permitting process	X				
Advocate for Cleaner, Low-Emissions Fuel in the Region					
Incentivize the use of renewable diesel and other clean fuel options and support greater access to renewable diesel at retail pumps across the region	X	X			X
Alternative or reduced fuel taxes applied to low-carbon fuels such as renewable diesel to reduce cost disparities with traditional diesel	X	X			X
Advocate for greater access to hydrogen across the region	X				

Align Clean Energy Incentives

Incentive availability is currently limited and varies across jurisdictions. Jurisdictions have different permit fees, making a broad-sweeping fee-based incentive difficult to establish. Furthermore, in the absence of broader or consistent incentives, productions in the region will continue to plan for generator power and only pursue anecdotal and piece meal reduction or replacement opportunities.

Short Term

Recommendation: As a regional convenor, Metro Vancouver should encourage member jurisdictions to consolidate their respective film permit processes under a single office and fee structure. Having consistent permit fees and processes could also allow for regional clean energy incentive programs.

Recommendation: Metro Vancouver could advocate for all member jurisdictions to create consistent clean energy incentives and, where possible, permit rebates across the region.

- If the permit process and fees were aligned in all jurisdictions, or indexed according to activities, location and film days, a transparent and predictable rebate could be equitably applied across the Metro Vancouver region. Regional consistency is likely to be welcomed by productions that film in multiple jurisdictions.
- Consider hiring an external expert in incentive research and development to facilitate the creation of an impactful incentive.

Improve Data Collection

The process of collecting filming related data is inconsistent and incomplete across Metro Vancouver jurisdictions. A fulsome assessment of emissions reduction and/or clean energy investment opportunities in priority areas is difficult without accurate data on total filming days, or generator locations and uses. Consistent cross-jurisdictional data would facilitate a regional strategic approach to reducing filming related emissions in Metro Vancouver.

Short Term

Recommendation: Metro Vancouver and all member jurisdictions to collect relevant and consistent emissions-related data via their film permitting process.

- Given its role in regulating air quality and controlling emissions, Metro Vancouver could develop and provide a template of relevant questions for jurisdictions to include in their respective permitting processes. Further, a consistent data collection methodology is also recommended for use in each jurisdiction.
- Metro Vancouver and its member jurisdictions to consistently collect relevant filming data for the permits they issue, notably:
 - The number of location as well as studio/facility filming days;
 - The locations and frequency of grid ties and mobile batteries used;
 - The numbers and types/sizes of generators used by productions;
 - Parking locations of these generators.

- Metro Vancouver and its member jurisdictions to require productions to submit generator and clean power use data to the [Generator Parking Locations Map](#).⁶⁷
- For cross-checking purposes, relevant member jurisdiction staff could support the reporting of generators and clean power usage when conducting site supervision or support activities for productions.
- Use this data to inform the potential development of a regional Clean Energy Filming Standard (page 41).

Recommendation: Metro Vancouver and its member jurisdictions to engage with [Creative BC's Clean Energy Committee](#) to compile and utilize regional data that is collected.

- Ensure each party consistently receives quality data from production to collectively better understand regional consumption patterns and opportunities for reduction.
- Each party to share learnings and processes to continually improve and expand the data collection process and maintain quality.
- Utilize regional data collection findings to inform provincial-level information and communication needs as well as potential future initiatives.
- Utilize regional data collection findings to engage BC Hydro on their municipal power kiosk infrastructure funding program.

Accelerate Infrastructure Development and Use

The limited availability of clean infrastructure and technology is a key barrier preventing productions from using clean power. Until the infrastructure is more widely available and accessible, it is not feasible to request productions to avoid all generator use on production. As more grid ties are encouraged, developed, and mapped across Metro Vancouver, greater potential for decreasing generator use is anticipated in urban settings.

Intermediate Term

Recommendation: Metro Vancouver to facilitate the creation of a cohesive plan in conjunction with all municipalities to rapidly assess and install grid power access locations (e.g., power kiosks, tie-ins) at popular filming and basecamp/circus parking locations across the Metro Vancouver region.

Short Term

Recommendation: All locations with grid power access should be clearly communicated and mandated to productions throughout the jurisdictional permitting process, as well as publicly through the [Grid Power Access Map](#).

Recommendation: Metro Vancouver to continue engaging Creative BC's Clean Energy Committee to vet existing and potential future grid power access locations at popular filming and basecamp/circus parking locations within Metro Vancouver's Regional Parks.

⁶⁷ Grid power access is more prevalent in the City of Vancouver than other municipalities according to the [Grid Power Access Map](#). This access is not so much due to unavailability outside of the City of Vancouver, but that it hasn't been consistently sought out or reported if used.

Recommendation: Metro Vancouver and its member jurisdictions to engage with BC Hydro and apply for BC Hydro's existing power kiosk infrastructure development incentives to install these based on the high frequency film sites identified in the report for their jurisdiction.

- BC Hydro provides [funding support](#) to municipalities for grid access, and purpose-built power kiosks for the film industry.

Recommendation: The region's member jurisdictions to incorporate confirmation of adequate power availability into building permits and business licences. As facilities consider their strategies for upgrading power capacity to provide EV charging, adding grid tie-ins to generator parking areas on the facility's property should also be considered.

- The Metro Vancouver region is currently undergoing a significant build phase of new studio facilities. Member jurisdictions should work to ensure that no future facility be built without adequate grid power access so productions based in these facilities can operate generator free.
- For existing studio facilities, member municipalities may consider requesting an updated clean energy plan before renewing business operating licenses.
- Relevant municipal representatives to work with Creative BC's Clean Energy Committee in its engagement with BC Hydro and studio facilities to accelerate power upgrades.

Recommendation: Metro Vancouver member jurisdictions, BC Hydro, and the Province of BC (where relevant) to consider incorporating grid power access for filming activities wherever capital development projects are occurring.

Accelerate Power Service Upgrades at Studio Facilities

Both productions and studio facilities need more large-scale clean power available, yet grid power constraints represent a barrier for many facilities to upgrade their power needs.

Short Term

Recommendation: Metro Vancouver's member municipalities to regularly engage and collaborate with Creative BC's Clean Energy Committee and BC Hydro to identify the best opportunities and timing to upgrade power service in areas with studio facilities and high location filming activity.

- Studio facilities to be encouraged to add cleaner temporary power generation on site.
- Studio facilities to be informed of clean energy and infrastructure upgrade incentives.
- Studios that are unable to upgrade their power needs due to power supply constraints ought to be mandated to switch from supplemental diesel generated power to grid power once upgraded power is locally available.

Recommendation: Metro Vancouver and its member jurisdictions to work with BC Hydro to coordinate the installation of additional EV charging hubs near studio facilities as well as popular filming locations.

Amplify Metro Vancouver Regional Parks' Permit Application and Clean Energy Discount

Only one production received Metro Vancouver Parks' [Clean Energy Discount](#) in 2022 despite the permit rebate incentive being introduced at the beginning of the year. The low use rate could be attributable to limited communication about the rebate during the permitting process.

Short Term

Recommendation: Metro Vancouver Parks Film Liaisons should share details about the Clean Energy Discount throughout the scouting and permit application process so that location managers and electrician supervisors are aware of it and can plan accordingly.

- Include details about the locations and power availability for all grid power access points.
- Add all grid access locations to the [Grid Power Access Map](#) and refer this resource to productions.

Recommendation: Metro Vancouver Parks should collect additional data from film productions related to clean power. Data could be collected via the permitting process or follow-up surveys, notably:

- Record and report the number of productions applying for and receiving the Metro Vancouver Parks Clean Energy Discount,
- Grid or battery power use (where/when applicable),
- Number and type of generators replaced with clean power (where/when applicable),
- Type of clean power used, and any challenges experienced,
- Number and type of generators used.

All permit data to be collected in a spreadsheet format for ease of use, access and analysis.

Intermediate Term

Recommendation: Metro Vancouver should continue to analyze data to inform future investment in clean infrastructure in Regional Parks to eliminate generators.

Advocate for Cleaner, Low-Emissions Fuel in the Region

A clean energy transition in the Metro Vancouver Region requires collaboration across all levels of government that regulate fuel in the region. Until generators are deprioritised and/or eliminated, cost-effective alternative fuel options provide near term emission reduction opportunities.

Short Term

Recommendation: Metro Vancouver to work with member municipalities and advocate for the following:

- Stronger low-carbon/clean fuel standards to incentivize the use of renewable diesel and other clean fuel options;
- Greater access to renewable diesel at commercial fueling stations across the region;
- Alternative or reduced fuel taxes applied to low-carbon fuels such as renewable diesel to reduce cost disparities with traditional diesel;
- Greater access to hydrogen across the region.



The City of Vancouver's diesel fleet (40% of the city's fleet) currently runs on renewable diesel. Credit: [City of Vancouver](#)

Section 8 – Metro Vancouver Parks Clean Power Pilot Project

With 244 documented filming days in 2021, Metro Vancouver’s Regional Parks were firmly in the top five filming jurisdictions within the region of Metro Vancouver. This provides a strong rationale for clean power pilot project opportunities in the near term within Metro Vancouver’s Regional Parks. Such pilot projects would reduce diesel generator use at specific locations, thereby supporting targets and objectives specified under Metro Vancouver’s *Climate 2050 Strategic Framework* as well as its *Clean Air Plan*.

The most popular filming locations within Metro Vancouver’s Regional Parks, based on a 3-year average (2019-2021), are provided in Table 9 below. Although data did not reveal the specific location of generators, most locations allow parking at a consistent site, thereby presenting a good opportunity to assess each site’s viability of developing power kiosk infrastructure for circus parking needs. In doing so, a power kiosk in such locations would contribute to the elimination of at least one 1400 A diesel generator.

A cost recovery rationale is typically used to identify future development potential for power kiosks throughout Metro Vancouver, Toronto, and London (UK) jurisdictions. Metro Vancouver’s Regional Parks most frequently used sites, such as the Lower Seymour Conservation Reserve (LSCR) and Capilano River, provide the strongest rationale for a return on investment.

Table 9: Top Five Filming Locations with Metro Vancouver Regional Parks (2019-2021)

Metro Vancouver Regional Parks / Conservation Areas	Filming Activity Days (2019-2021)	
	3-year average	3-year total
1. Lower Seymour Conservation Reserve	70	211
2. Capilano River	41	123
3. Belcarra	41	122
4. Aldergrove	32	97
5. Derby Reach	26	77

Eliminating the need for a circus generator would reduce GHG emissions from 0.69 tCO₂e/day to 0.00489 tCO₂e/day (a 99% reduction)⁶⁸. Using 2021 data for filming days and assuming this rate remains consistent for medium-sized productions, a power kiosk could reduce GHG emissions in the LSCR and Capilano River by 47.96 tCO₂e/year and 28.1 tCO₂e/year, respectively. Nitrogen oxides, carbon monoxide and particulate matter would also be eliminated at these sites.

Pilot Project Next Steps

The following steps are recommended to identify quick wins and pursue site assessments and the installation of a power kiosk at Metro Vancouver Regional Parks' top filming locations:

1. Accelerate awareness and use of Metro Vancouver's clean energy incentives through a broader communications program and by encouraging all permitted productions to use clean power sources when filming.
2. Make any existing grid power at or near top filming locations available and accessible to productions. In the immediate term, this enables access to grid power which reduces generator loads and/or run times even if it may not eliminate diesel generator use.
 - Build awareness and connect productions to available power sources through the existing permit pre-approval/site visit process.
3. Require productions to provide specific generator locations for circus, as well as other applications, within popular Regional Parks filming locations.
4. Focus site assessment potential on circus/basecamp parking at Lower Seymour Conservation Reserve, Capilano River or Belcarra as a priority to map out ideal power kiosk locations.
5. Engage BC Hydro for a site assessment related to power kiosk opportunities. This will help determine site requirements, potential trenching needs to site, and whether there are any power access constraints on the local circuit.
6. Assess costs. Power kiosks themselves are not the most significant cost as compared to trenching, distance from available power, and any circuit upgrades.
 - Engage Creative BC's Clean Energy Committee for potential access to clean energy incentives related to site assessments.⁶⁹
7. Explore Metro Vancouver's potential to access BC Hydro's power kiosk infrastructure development incentives for up to 50% of electrical infrastructure costs.⁷⁰
8. Build awareness and use of any power kiosk development and adapt existing incentive programs to further enable their use.
9. If the highest use Regional Parks do not have the right conditions for infrastructure development, focus instead on proof of practice in another park that is still heavily used but cheaper to install a power kiosk in.
10. If Grid Power is not an option at these sites – explore opportunities to facilitate temporary installation of renewable fuel power generation, e.g. Green Hydrogen.

⁶⁸ Based on calculations provided in [Appendix 5B](#)

⁶⁹ Creative BC, [Power Tie-Ins Program](#)

⁷⁰ BC Hydro, [Electric power for film sets](#)



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APPENDIX 1

A1. Power and the Motion-Picture Industry: Research and Engagement (4 Cities)

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1A. Soundstage Facility Power

	<i>Metro Vancouver</i>	<i>Greater Toronto Area</i>	<i>New York</i>	<i>Los Angeles</i>
Facilities power availability	<p>"There are a few purpose built facilities in the region, with several more being built, though most of Metro Vancouver's facilities are converted warehouses.</p> <p>Most purpose built facilities have adequate power for stages.</p> <p>Some purpose built facilities have adequate grid power for set, equipment trucks, and circus/basecamp.</p> <p>Many purpose built facilities require at least 1 diesel generator for support areas.</p> <p>Most converted studio facilities require supplemental power supplied by 1 or more generators.</p> <p>Power availability limitations are due to lack of infrastructure on site, or constraints within the BC Hydro service connection."</p>	<p>Most facilities are converted warehouses without enough power due to a lack of grid power availability, lack of upgraded transformers, or other infrastructure challenges.</p> <p>Respondents estimated that 80% of facilities do not have enough power, so productions have to use generators to augment or supplement facility power for circus, work trucks or SPFX. Purpose-built studios have enough power for stage and backlot needs, but this only applies to 5-6 facilities in Toronto.</p>	<p>No quantitative information could be confirmed on purpose-built versus converted facilities, although anecdotally it appears that most facilities were not purpose built. Purpose-built facilities have enough power for all production needs. 1 facility has solar panels that supplement some power needs, such as the carpentry lot. Another facility has solar panels that contribute to 30% of the facility's power.</p>	<p>Most studios & stages in LA are purpose built. Purpose-built facilities usually have enough power for production needs (including stages, backlot and support vehicles), though it is not unheard-of to bring in a generator for very large circus/basecamp or special purposes (eg. SPFX, lighting). Productions want to have full control of power, so will supplement if needed.</p> <p>As a general practice though, there is enough for both stage, backlot, and support vehicle purposes (through cabling). Those converted warehouse buildings in LA have the same limitations as elsewhere.</p>
Generators used for support vehicle purposes	<p>Almost always, likely a 1400A generator due to local stock inventory and industry observations. Often located on studio property, such as the parking lot.</p>	<p>Estimated ~80% of the time for support vehicle purposes. Generator size will vary based on needs. Often located on studio property, such as the parking lot.</p>	<p>Using generators for support vehicle power in converted facilities is something that happens. It is not necessarily common, but it certainly occurs often.</p>	<p>Occasionally, if the circus is very large. Depends on the facility, mostly limited to converted facilities.</p>
Generators used for facilities power	<p>"Studios may need supplemental or backup power in addition to stage power for production specific needs (eg. special lighting, SPFX).</p> <p>Most existing facilities are converted and do not have enough power for stages and support vehicles in the parking lot, so power is supplemented by generators."</p>	<p>"Occasionally at purpose-built studios for production specific needs (eg. special lighting, SPFX). Most existing facilities are converted and do not have enough power for stages and support vehicles in the parking lot, so power is supplemented by generators."</p>	<p>Many facilities have small parking lots that cannot accommodate full-sized circuses or tie them into facility power, which means that circuses are likely powered by generators.</p>	<p>Rarely for special power needs (eg. SPFX, lighting)</p>
Peak power demand scenario	<p>For example: all stages in use at the same time, backlot is full (i.e. circus, work trailers, etc.), and lighting/SPFX or other needs require separate power from the main studio source.</p>	<p>For example: all stages in use at the same time, backlot is full (i.e. circus, work trailers, etc.), and lighting/SPFX or other needs require separate power from the main studio source.</p>	<p>For example: all stages in use at the same time, backlot is full (i.e. circus, work trailers, etc.), and lighting/SPFX or other needs require separate power from the main studio source.</p>	<p>Most facilities are purpose-built and provide sufficient power for production needs.</p>

1A. Soundstage Facility Power, cont.

	<i>Metro Vancouver</i>	<i>Greater Toronto Area</i>	<i>New York</i>	<i>Los Angeles</i>
EV charging	Few facilities have EV charging, though they have identified this as a priority area for development. Many are investing or planning to invest in EV chargers. For example, 2 of 17 MBS studios have EV chargers, but more are in development. Other facilities with Level 2 chargers include Bridge Studios, Vancouver Film Studios, Martini Studios, and William F. White Studios.	Fewer than 10% of facilities have EV charging. Some productions invest in them when they will be at a facility for a while. Upgrade cost is balanced by cost savings from fuel.	"Based on limited stakeholder engagement, very few facilities have EV charging stations. One facility noted they have no dedicated charging, but upgraded their power boxes to cable out and charge EVs. Usually have around 5 EVs to charge. Another facility noted they had no EV chargers, and the impression is that EV charging is still a while away."	Available in limited capacity.
Grid tie-ins	A few facilities have grid tie-ins for the backlot or parking areas. These grid tie-ins are usually insufficient for all production needs, so some production areas (e.g. work trucks, circus) use additional mobile power.	The 5-6 purpose-built facilities have grid tie-ins. Not so for converted facilities.	Similar to EV charging, facilities typically cable power to outdoor production locations rather than providing dedicated tie-in infrastructure. At 1 facility, there are no grid tie-ins on the lot, but the facility can power all production studio and circus needs through cabling.	Studio facilities connect productions to power through grid tie-ins in their lot, or more commonly cabling from the studio.

1B. Mobile Power

	<i>Metro Vancouver</i>	<i>Greater Toronto Area</i>	<i>New York</i>	<i>Los Angeles</i>
Types of Diesel Generators in Use	Due to vendor inventory, most local stock is 3-phase 1400 - 1600A Generators, with very limited stock of smaller generators (less than 10). Productions therefore use these for both locations and studio parking lot purposes. Operating at 50% capacity (very rare scenario), a 1400A generator running on diesel consumes about 27.6 L/hour, and at 25% capacity (typical scenario) consumes about 16.2 L/hour.	Local stock includes a wide range of generator size and capacity, from 400A - 1800A. Productions use these for both locations and studio parking lot purposes.	Local stock includes a range of generators size and capacity. In New York, a common type of diesel generator is the "Van Genny", which can typically be 900, 1200, or 1400 As and are hidden in plain sight in vans so productions can film in busy streets. In contrast, "Tractor Gennys" are typically 1200, 1400, or 1800 As. Productions typically use an 1800 A tractor genny for circus, although data shows that they rarely need more than 1200 As of power to accommodate surges (can be up to 700 As).	Local stock includes a wide range of generator size and capacity, primarily for locations filming purposes.

1B. Mobile Power, cont.

	<i>Metro Vancouver</i>	<i>Greater Toronto Area</i>	<i>New York</i>	<i>Los Angeles</i>
Types of Diesel Generators in Use, cont.	Over a 14-hour shoot day, a 25% capacity 1400A generator therefore consumes 226.8 L of diesel, emitting about 5.7 lb. of CO2 equivalent per L so a total of 0.6 metric tonnes of CO2 equivalent. Data from field consumption data collection.		For set power, productions usually use 1200 or 1400 amp gennys even though maximum power usage is typically only 500 As for daytime or 900 As for nighttime. Numbers are based on information from average medium-sized productions.	
Generators used on location	Generators are typically used well below maximum capacity. Average 3-4 large generators to power circus/circus, as well as set (lighting, SPFX), catering, and auxiliary areas depending on site layout, with smaller generators around set as needed. Specific production needs determine the number and usage of generators, can be up to 20 generators.	Generators are typically used well below maximum capacity. Usually 3 large generators per day, more if a bigger show, and can limit smaller shows to 2 generators. Other small generators if needed. Toronto equipment houses have multiple sizes of generators available, but larger productions go with the biggest 1200A generators.	For set power, productions usually use 1200 or 1400 amp gennys even though maximum power usage is typically only 500 As for daytime or 900 As for nighttime. Numbers are based on information from average medium-sized productions.	For set power, productions usually use 1200 or 1400 amp gennys even though maximum power usage is typically only 500 As for daytime or 900 As for nighttime. Numbers are based on information from average medium-sized productions.
Mobile batteries	Used in a variety of areas to replace generators or reduce their use, depending on production needs and location/set layout. Smaller power draws (e.g. lighting, camera equipment, SPFX, catering) can be fully replaced by smaller mobile batteries. Larger power draws (e.g. circus, surges) can be powered using a battery-generator hybrid system, reducing fuel consumption. There are currently few mobile batteries with more than 600A of power on the market. The region has the largest mobile batteries available in the world, currently at 96kW.	Limited, but increasingly available through equipment suppliers and used for sensitive set areas, or to limit cabling. Viewed as a key part of the clean energy solution. Largest available battery provides 72kW.	Available and rented locally and have been able to fully replace on-set generators, and reduce fuel consumption through hybridizing with the circus generator. Most common use is the 5kW, though larger units are being developed and piloted. A vendor observed that demand is increasing, and larger, more powerful batteries are becoming available and the landscape is changing rapidly. However, use is still less common compared to generators. Charging in 4-5 hours. Working with studios to understand usage and data on how much power they supplied on set.	Available and rented locally, primarily 6kW and recently introduced the 30kW. A vendor observed that demand is increasing, and larger, more powerful batteries are becoming available. Partnerships between major film studios and mobile battery power companies are also beginning to emerge. However, use is still less common compared to generators. Working with studios to understand usage and data on how much power they supplied on set.

1B. Mobile Power, cont.

	<i>Metro Vancouver</i>	<i>Greater Toronto Area</i>	<i>New York</i>	<i>Los Angeles</i>
Solar / Other RE	"Solar power supplements trailers, but is not fully sufficient for trailer power in adverse temperatures unless combined with batteries. Solar charging accessories for batteries are often used in summertime."	Solar power supplements trailers, but is not fully sufficient for trailer power in adverse temperatures.	"Solar power supplements trailers, but is not fully sufficient for trailer power in adverse temperatures. Solar charging accessories for batteries are often used in summertime."	"Solar power supplements trailers, but is not fully sufficient for trailer power in adverse temperatures (e.g. air conditioning in summer). Solar charging accessories for batteries are often used in summertime."
Alternative fuels/ power	MBSE rents generators filled with RD, though RD is not yet widely available in MV. Once rented, vendors have limited control (outside of rental agreements) over which fuel productions use in their generators. Diesel fuel across the province includes 4% renewable content per provincial regulations. RNG is pumped through the NG pipes for studio heating.	No experience with alternative fuels, beyond what is blended in Ontario's fuel supply.	Limited to no availability in New York City.	RD is available at 76 Gas Stations in California. However, most production trucks use fuel trucks rather than retail gas stations. RD has had some penetration in the film industry fuel trucks. It is generally cost-competitive, with some potential premium for bringing it on to production.
Cost/Accessibility/ Other Barriers	"Battery rentals are expensive for productions. Small (2k and 6k) battery units are about 33% more expensive than similarly-sized gas generators. Local equipment vendors supply a 1500 A generator for \$1800/wk, as compared to their large battery unit at \$3750/ wk. The offset of fuel savings is rarely considered at time of rental. Health and Safety factors from improved air quality are also not considered. Other barriers include resistance or lack of awareness from and experience with the industry and lack of availability at circus locations. Also, the crews work long hours and are tired so educating them to make changes is challenging. RD barriers include the cost premium and limited availability in MV."	No alternative fuels, limited access to powerful-enough batteries and limited places to charge them. Resistance comes from the industry: concerns about running out of power, and about asking locations to charge batteries from the grid. Charging the batteries is a challenge.	Mobile battery power is now being offered at competitive prices, considering rental fees and fuel savings. Local vendor is educating crews about the cost savings and other benefits of using mobile battery power by approaching the budget holistically. The main barrier is human behaviour, as people are set in their ways and resist change. Another barrier is lack of knowledge and education for the gaffers (electrical technicians) and producers. In addition, the logistics for charging and transporting batteries are a challenge. Another barrier is that there is a supply chain backlog slowing down the ability to bring bigger batteries to the market.	Dedicated charging equipment will be a must as it develops, especially for above-the-line folks. Not there yet.

1C. Grid Tie-ins and Power Kiosks

	<i>Metro Vancouver</i>	<i>Greater Toronto Area</i>	<i>New York</i>	<i>Los Angeles</i>
Availability	<p>"154 tie-ins mostly available through private locations, with MapMe data on these locations as well as high generator-usage locations. City of Vancouver is installing 25 public power drops in the next 8 years - first 6 coming online in the next year. Several other municipalities are initiating plans for tie-ins (Surrey, Maple Ridge, etc) based on frequent use sites.</p> <p>Tie-ins typically range from 100-400A. Where the full range is available, these are sufficient for most production needs. Installation requires coordination with site owners, municipal services, and BC Hydro for feasibility. In 2022, BC Hydro has set aside funds for film industry power kiosk funding for qualifying municipalities.</p> <p>Growing industry practice is to hire a locations manager to seek out possible private tie-ins."</p>	<p>Two grid tie-ins/power kiosks were developed and launched as a pilot project at popular filming locations by the City of Toronto in September 2022. Developed collaboratively with different boards in the city (e.g. Parks, Transportation), the film industry, and the film permit office. All city teams and the industry are on board with having more grid tie-ins in the future, which is expediting the process.</p>	<p>Grid tie-ins are not publicly available in New York City, or provided by the municipality. However, tying into the grid for set power is common when filming on location in high-rises or other properties where generators cannot be used. Grid power is also used in soundstage backlots and some warehouses.</p>	<p>"Three grid tie-ins available throughout LA, installed in 2007. Initially there was very limited industry use, and they have now been largely abandoned due to lack of communication during permitting, resistance from the industry, and possible concerns that using grid power could lead to union job loss for generator operators. In addition, grid tie-ins are located at filming sites rather than circus parking locations which are more consistently used. No ownership or agency to advance the use of these grid-ties within local municipal offices. Local municipalities do not see this as their responsibility, yet are aware of and support CoV's efforts in this regard.</p> <p>US studios under the Sustainable Production Alliance in collaboration with local officials such as Film LA are looking to overcome barriers and advance municipal grid tie-ins in the LA region in the mid-term."</p>
Air quality regulations	<p>Grid tie-in efforts are not directly connected with air quality regulations, but conversations about reducing noise and improving air quality are ongoing and often inform the process.</p>	<p>Grid tie-in efforts are not connected to any air quality regulations. However, all sectors in the City of Toronto are focused on clean energy initiatives.</p>	<p>Not applicable. No links to film permits and air quality regulations.</p>	<p>Not applicable. No links to film permits and air quality regulations.</p>
Cost/Accessibility / Other Barriers	<p>"Installing grid tie-ins is expensive for the city (costs vary by site) and requires CapEx planning. But using them is not expensive for productions (regular electricity fees - \$250/day for 400A). Human behaviour barrier - not asking if they exist or are available.</p>	<p>"Unavailable, and resistance to asking locations to allow grid tie-in-ins. Some productions ask for grid tie-in-ins on some larger locations, but there is resistance from the locations.</p>	<p>According to one interviewee, the main barrier for installing grid tie-in-ins is the major infrastructure overhaul it would require, for something that would only benefit films and maybe events. The local film industry is very grassroots about sustainability, so action is happening at the producer level.</p>	<p>Resistance from the industry to grid tie use, so they are currently underutilized.</p>

1C. Grid Tie-ins and Power Kiosks, cont.

	<i>Metro Vancouver</i>	<i>Greater Toronto Area</i>	<i>New York</i>	<i>Los Angeles</i>
Cost/Accessibility/ Other Barriers, cont.	For productions, it can be difficult and time-consuming to identify the appropriate person to contact if they want to tie in to building power, especially on a private property that is not listed on the Clean power MapMe tool. Behaviour is another barrier, as people prefer to continue doing things the way they have before - tying into the most powerful generator because it is convenient and perceived to be less expensive up front. Lack of training and education about more sustainable ways to use generators is also a barrier because the industry moves so quickly."	An average power drop will cost the City of Toronto about 200,000 to install. Productions will only be charged for electricity consumption and a \$400 admin fee. This has all been assessed to be on par with generator rentals and fuel costs. Each grid tie-in-in is expected to avoid about 200 t CO2 per year, according to City calculations."		
Quantification	"Location managers are collecting usage data at the VAG site, based on the number of filming days and access to tie-ins. Quantification based on days used, not power consumption. Data is being collected by the City of Vancouver through their film permit rebate program, however the data remains confidential at this time. The City of Vancouver is using generator parking and permit data in addition to power availability and upcoming infrastructure development projects to determine sites for future public power kiosks. Productions receive the rebate whether they use a battery or tie into the grid. About 30% of productions who receive a film permit also receive the rebate, about 500 productions. The focus right now is on starting the program, and analytics will come later."	Data collection is in progress by the City of Toronto, ongoing for 3 years. Determinants for first power drop locations are city ownership, cost, and popular filming/circus sites. These power drops will be billed separately from film permit fees (starting June 1st, 2022) and power consumption will be tracked by Toronto and reported back to productions.	Not applicable	Grid tie-ins not currently used by industry.

1D. Municipal Incentives and Regulations for Clean Power

	<i>Metro Vancouver</i>	<i>Greater Toronto Area</i>	<i>New York</i>	<i>Los Angeles</i>
Permit requirements	"Across MV productions are charged for daily public permits (though municipal departments issuing the permits vary). In CoV they are required to submit generator usage information, though there are some compliance challenges. Other municipalities request but don't require this usage information. Permits not provided at VAG site unless productions commit to tie in and not bring generators."	As of mid-2022, Toronto start to charge for film permits for public locations. Part of that revenue will eventually support grid power drop developments, but for now they are separate projects. No generator usage requirements or limitations associated with permit requirements.	None linked to clean power. However, the Mayor's office generates a "hot zone" map to identify areas with filming fatigue to restrict permits in those areas. This "hot zone" map is not specific to filming, but includes all other industries as well as considering events like emergencies and construction.	No permit requirements in LA for clean power or metrics on generator usage.
Financial Incentives	154 tie-ins mostly available through private locations, with MapMe data on these locations as well as high generator-usage locations. City of Vancouver is installing 25 public power drops in the next 8 years - first 6 coming online in the next year. Several other municipalities are initiating plans for tie-ins (Surrey, Maple Ridge, etc) based on frequent use sites. Tie-ins typically range from 100-400A. Where the full range is available, these are sufficient for most production needs. Installation requires coordination with site owners, municipal services, and BC Hydro for feasibility. <u>In 2022, BC Hydro has set aside funds for film industry power kiosk funding for qualifying municipalities.</u> Growing industry practice is to hire a locations manager to seek out possible private tie-ins.	Currently no incentives in Toronto. Grid power will cost \$400 admin + kW usage, and will be on par with generator rental fees. Production savings will be primarily from no fuel costs.	No incentives in NYC for clean power. However, the NYC Film Green program allows productions to pursue an official seal that recognizes their sustainability efforts, like waste diversion, energy efficiency, etc. There is an audit at the end of the production in order to award the seal.	No incentives in LA for clean power.

1E. Power Wish List & Future Needs

	<i>Metro Vancouver</i>	<i>Greater Toronto Area</i>	<i>New York</i>	<i>Los Angeles</i>
Role of municipal government	<ul style="list-style-type: none"> "- Data collection at the permitting phase. - Continue to install grid tie-ins for productions. - Consider film industry needs in any infrastructure upgrading process. - Mandate generator-free shoots in locations where clean power is available." 	<ul style="list-style-type: none"> "- Installing power drops/grid ties for productions and mandating their use. Will include events, food trucks, and other users in the future as all stakeholders are interested in doing so, but the short-term rollout will be film focused for troubleshooting reasons. - Mandate other clean power practices for productions. - Push for alternative fuels, power, and low-emissions vehicles." 	<ul style="list-style-type: none"> "- Require productions to collect and submit data related to generators, emissions, consumption, etc., - Provide an incentive for productions to reduce emissions based on baseline data collected through that process." 	<ul style="list-style-type: none"> Support clean power infrastructure development and mandates.



APPENDIX 1

1F. Consumption Data: Six Green Spark Group Sample Productions

Vancouver Production 1 p. 12

Year: 2021
Timeframe: Aug 2020-May 2021
Total Emissions (MT CO2e): 1,476.00

Toronto Production 4 p. 18

Year: 2021
Timeframe: Feb - July 2021
Total Emissions (MT CO2e): 1,458.00

Vancouver Production 2 p. 14

Year: 2017
Timeframe: Mar - Dec 2017
Total Emissions (MT CO2e): 1,299.00

NYC Production 5 p. 20

Year: 2021
Timeframe: July - Dec 2021
Total Emissions (MT CO2e): 613.00

Vanc. Production 3 p. 16

Year: 2019
Timeframe: Sept 2018-Apr 2019
Total Emissions (MT CO2e): 1,497.00

LA Production 6 p. 22

Year: 2019 - 2020
Timeframe: Oct 2019 - Mar 2020
Total Emissions (MT CO2e): 398.00

Vancouver Production 1

Region	Production	Year	Timeline	Total Emissions(MT CO ₂ e)
Vancouver	GSG Client	2021	Aug 2020-May 2021	1,476.00

Studio, Location, Production Notes:

NEW PRODUCTION (with alternative fuel use)
Television series. Data from one season. Different stages were used.

Power Source	Consumption	Emissions (MT CO ₂ e)	Specific Applications	Peak demand profile	Use / Runtime	Notes
Utilities (kWh)	62,912.00	1.00	Production Office		Total	Unsure as further utilities data was unavailable. Uncertain if there was no natural gas heating at the facility, or if data were simply not available.
Grid tie-ins (kWh)						
Generators (diesel) (L)						
Generators (gas) (L)						
Vehicles (diesel) (L)						
Vehicles (gas) (L)						
Other volume (diesel) (L)	234,740.20	732.90	Vehicles, generators, lifts		Total	Total fuel use emitted 1,374 MT CO ₂ e, or 93% of emissions. Fuels were not broken down by usage. Specific emissions were calculated using the albert carbon calculator.
Other volume (gas) (L)	20,460.99	57.22	Vehicles		Total	"Total fuel use emitted 1,374 MT CO ₂ e, or 93% of emissions. Fuels were not broken down by usage. Specific emissions calculated using albert.
Other volume (gas) (L), cont.	20,460.99	57.22	Vehicles		Total	A hybrid vehicle was driven 7,836 kms, avoiding an estimated 1 MT CO ₂ e according to PEAR."

** Grey cells indicate no data available

Vancouver Production 1, cont.

Region	Production	Year	Timeline	Total Emissions(MT CO ₂ e)
Vancouver	GSG Client	2021	Aug 2020-May 2021	1,476.00

Studio, Location, Production Notes:

NEW PRODUCTION (with alternative fuel use)
Television series. Data from one season. Different stages were used.

Power Source	Consumption	Emissions (MT CO ₂ e)	Specific Applications	Peak demand profile	Use / Runtime	Notes
Propane (L)	20,460.99	33.79	Unknown		Total	albert does not include propane in Litres, so could not determine emissions this way
Natural Gas (facilities) (Megajoules)						

Clean/Alternative Power	Used (Type(s))	Consumption	Specific Applications	Energy Savings	Emissions Savings (metric tonnes of CO ₂ equivalent, MT CO ₂ e)	Notes
Solar/Other RE						
Mobile Batteries						
Biofuels / Renewable diesel	Renewable Diesel	"174,195.91 L Costing \$1.39/L 27.3% of total fuel purchases"	Generators and vehicles	NA	Estimated 70-80% fewer lifecycle emissions	RD pilot project on production. Emissions reduction is estimated because feedstock and lifecycle emissions reduction were not available. In total, 408,936 L of combined diesel and RD were purchased for the production.
Hydrogen	n/a	n/a	n/a	n/a	n/a	n/a

** Grey cells indicate no data available

Vancouver Production 2

Region	Production	Year	Timeline	Total Emissions(MT CO ₂ e)
Vancouver	GSG Client	2017	Mar - Dec 2017	1,299.00

Studio, Location, Production Notes:

Television series. Data from one season.
Used grid power in studio and generators on location when grid power was unavailable.

Power Source	Consumption	Emissions (MT CO ₂ e)	Specific Applications	Peak demand profile	Use / Runtime	Notes
Utilities (kWh)	508,574.00	116.00	Studio		Total	Emissions includes natural gas. Could not differentiate based on available data.
Grid tie-ins (kWh)						
Generators (diesel) (L)	See notes					Production diesel was not delineated into "generator" or "vehicle" uses.
Generators (gas) (L)	53.94	0.15	Generator		Total	Gas generators are small and used less frequently than diesel generators
Vehicles (diesel) (L)	168,823.17	527.10	Vehicles, Transport		Total	Entered value assumed to be diesel.
Vehicles (gas) (L)	255,150.1	713.4	Vehicles		Total	Consumption includes petty cash
Other volume (diesel) (L)	8 4,252.68	9 13.28	Lift		Total	Entered value assumed to be diesel.
Other volume (gas) (L)	1,385.00	3.87	Lift		Total	Some "Lifts" were reported to use gas.
Natural Gas (facilities) (Megajoules)	2,256,430.00	Included in Utilities emissions	Heating		Total	Emissions included under natural gas. Could not differentiate based on available data, as albert requires facility area which was unavailable.

** Grey cells indicate no data available

Vancouver Production 2, cont.

Region	Production	Year	Timeline	Total Emissions(MT CO ₂ e)
Vancouver	GSG Client	2017	Mar - Dec 2017	1,299.00

Studio, Location, Production Notes:

Television series. Data from one season.
Used grid power in studio and generators on location when grid power was unavailable.

Clean/Alternative Power	Used (Type(s))	Consumption	Specific Applications	Energy Savings	Emissions Savings (metric tonnes of CO ₂ equivalent, MT CO ₂ e)	Notes
Solar/Other RE						
Mobile Batteries	Portable Electric VOLTstack 5K and 13K	170.92 hours	"5k: daylight splinter units, DIT downloading after camera wrap, dollies, Techno 15, sound car, and a shorter time period for crafty and catering trucks. 13K: daylight scenes, cranes and amp, gear on barges and big daylight establishes, downtown areas and wherever generator placement was prohibited"	598 L of fuel consumption avoided, cost approximately \$814 CAD	"0.584 MT CO ₂ e avoided by using the 5K instead of diesel generator. 13K VOLTstack values not reported."	One of the first productions to test Portable Electric units. Use cases based on reported crew feedback. Other information pulled from wrap report.
Biofuels / Renewable diesel	n/a	n/a	n/a	n/a	n/a	n/a
Hydrogen	n/a	n/a	n/a	n/a	n/a	n/a

** Grey cells indicate no data available

Vancouver Production 3

Region	Production	Year	Timeline	Total Emissions(MT CO ₂ e)
Vancouver	GSG Client	2019	Sept 2018-Apr 2019	1,497.00

Studio, Location, Production Notes:

This production was the subsequent season from the previous example (Sample Production 2).
Used grid power in studio, and generators and mobile batteries on location when grid power was unavailable. Continued efforts developed from previous season.

Power Source	Consumption	Emissions (MT CO ₂ e)	Specific Applications	Peak demand profile	Use / Runtime	Notes
Utilities (kWh)	455,714.79	127.00	Studio, EV charging, Lockups, some locations		Total	Utilities emissions includes natural gas, calculated by PEAR
Grid tie-ins (kWh)			Set power, possible basecamp		Total	Trinity Power substation rented in Squamish - local transformer to tie into utilities. No consumption or use data recorded.
Generators (diesel and gas) (L)	48,671.00	n/a	Transportation department manages generators		Total	Transportation department fuel use was tracked: vehicles used 19,589L, and generators used 48,671L. Not broken down by diesel or gas, so emissions could not be calculated.
Vehicles (diesel and gas) (L)	19,589.00	n/a	Transportation department-managed vehicles		Total	Transportation department fuel use was tracked: vehicles used 19,589L, and generators used 48,671L. Not broken down by diesel or gas, so emissions could not be calculated.
TOTAL volume (diesel) (L)	222,605.00	695.02	Lifts, generators, marine, vehicles, trucks		Total	Includes the fuel values for generators and vehicles as tracked by the transportation department. All fuel emitted 1,120 MT CO ₂ e total according to PEAR.
TOTAL volume (gas) (L)	219,052.88	612.55	Vehicles		Total	Includes the fuel values for generators and vehicles as tracked by the transportation department. All fuel emitted 1,120 MT CO ₂ e total according to PEAR.
Propane (L)	9,080.59	2.05	Catering, Lifts, Transport, Marine		Total	Propane use was recorded in L, converted to kg for emissions estimate in albert
Natural Gas (facilities) (Megajoules)	2,484,900.00	Included in Utilities emissions	Heating		Total	Emissions included under natural gas. Could not differentiate based on available data, as albert requires facility area which was unavailable.

** Grey cells indicate no data available

Vancouver Production 3, cont.

Region	Production	Year	Timeline	Total Emissions(MT CO2e)
Vancouver	GSG Client	2019	Sept 2018-Apr 2019	1,497.00

Studio, Location, Production Notes:

This production was the subsequent season from the previous example (Sample Production 2). Used grid power in studio, and generators and mobile batteries on location when grid power was unavailable. Continued efforts developed from previous season.

Clean/Alternative Power	Used (Type(s))	Consumption	Specific Applications	Energy Savings	Emissions Savings (metric tonnes of CO2 equivalent, MT CO2e)	Notes
Solar/Other RE						
Mobile Batteries	Portable Electric VOLTstack 5K and 13K	93 hours	Lighting, catering, crane monitors, VV, smaller battery charging, sets, etc			Used the second time around for the same reasons and applications as the first; no pilot study conducted.
Biofuels / Renewable diesel						
Hydrogen	n/a	n/a	n/a	n/a	n/a	n/a

** Grey cells indicate no data available

Toronto Production 4

Region	Production	Year	Timeline	Total Emissions(MT CO ₂ e)
Toronto	GSG Client	2021	Feb-Jul 2021	1,458.00

Studio, Location, Production Notes:

Television series. Data from one season.
133 shoot days: 73 on location, 38 in studio. Locations were often remote. 15 days shot in the Toronto Congress Centre. Studio power was insufficient so generators were used on the lot.

Power Source	Consumption	Emissions (MT CO ₂ e)	Specific Applications	Peak demand profile	Use / Runtime	Notes
Utilities (kWh)		42.00	Studio, Office, Long- term location rental		81 days (Total)	Studio was a converted warehouse and soundstage power was not sufficient. Generators powered the support vehicle (e.g. circus and work trucks) and supplemented some stages.
Grid tie-ins (kWh)						
Generators (diesel) (L)						Production diesel was not delineated into "generator" or "vehicle" uses.
Generators (gas) (L)						
Vehicles (diesel) (L)						Production diesel was not delineated into "generator" or "vehicle" uses.
Vehicles (gas) (L)						
Other volume (diesel) (L)	146,898.50	460.78	Transport, Generators		Total	Fuel was not differentiated by use. Some consumption not reported. Spend and consumption emissions calculated using albert carbon calculator.
Other volume (gas) (L)	389,088.29	1,089.10	Transport, Crew vehicles		Total	Fuel was not differentiated by use. Some consumption not reported. Spend and consumption emissions calculated using albert carbon calculator.
Natural Gas (facilities) (Megajoules)						

** Grey cells indicate no data available

Toronto Production 4, cont.

Region	Production	Year	Timeline	Total Emissions(MT CO ₂ e)
Toronto	GSG Client	2021	Feb-Jul 2021	1,458.00

Studio, Location, Production Notes:

Television series. Data from one season.
133 shoot days: 73 on location, 38 in studio. Locations were often remote. 15 days shot in the Toronto Congress Centre. Studio power was insufficient so generators were used on the lot.

Clean/Alternative Power	Used (Type(s))	Consumption	Specific Applications	Energy Savings	Emissions Savings (metric tonnes of CO ₂ equivalent, MT CO ₂ e)	Notes
Solar/Other RE	Solar Trailers		Supplemental Trailer Power			"No use data recorded. Energy production was found to be insufficient. Diesel generators were used as backup."
Mobile Batteries	MBSE Canada UPS (x2)		Basecamp, Craft, Video Village, Set Lighting			"No use data recorded. Charging, transport, and parking of units all posed challenges. Due to remote power limitations, units were often charged using diesel generators."
Biofuels / Renewable diesel	B100	4 GAL	Unknown	n/a	0.0439 MT CO ₂ e avoided	Source and use not reported. Emissions savings calculated using albert carbon calculator.
Hydrogen	n/a	n/a	n/a	n/a	n/a	n/a

** Grey cells indicate no data available

New York City Production 5

Region	Production	Year	Timeline	Total Emissions (MT CO ₂ e)
New York City	GSG Client	2021	Jul-Dec 2021	613.00

Studio, Location, Production Notes:

Television series. Data from one season.

Total 73 shoot days, 38 on location, 35 on stages. Some consumption listed here occurred in India, as data were aggregated. It was a 10-day shoot with a splinter crew on location, and contributed only 0.72% to overall emissions.

Power Source	Consumption	Emissions (MT CO ₂ e)	Specific Applications	Peak demand profile	Use / Runtime	Notes
Utilities (kWh)	131,118.00	25.48	Production Office, Studio		Total	Stages had 30% renewable energy from solar roof
Grid tie-ins (kWh)						
Generators (diesel) (L)	22,838.18	59.39	Generators		Total	Fuel truck entries were assumed to be generators
Generators (gas) (L)	869.33	9.46	Generators		Total	Fuel truck entries were assumed to be generators
Vehicles (diesel) (L)	48,741.00	126.76	Vehicles, Trucks, Transport, Lifts		Total	Other vehicles were broken down but have been aggregated here.
Vehicles (gas) (L)	103,670.85	243.00	Vehicles, Trucks, Transport		Total	Other vehicles were broken down but have been aggregated here.
Other volume (diesel) (L)						
Other volume (gas) (L)						
Natural Gas (facilities) (Megajoules)						

** Grey cells indicate no data available

New York City Production 5, cont

Region	Production	Year	Timeline	Total Emissions(MT CO ₂ e)
New York City	GSG Client	2021	Jul-Dec 2021	613.00

Studio, Location, Production Notes:

Television series. Data from one season.

Total 73 shoot days, 38 on location, 35 on stages. Some consumption listed here occurred in India, as data were aggregated. It was a 10-day shoot with a splinter crew on location, and contributed only 0.72% to overall emissions.

Clean/Alternative Power	Used (Type(s))	Consumption	Specific Applications	Energy Savings	Emissions Savings (metric tonnes of CO ₂ equivalent, MT CO ₂ e)	Notes
Solar/Other RE	Solar Trailers		Cast Trailers			Use and consumption data not available.
Mobile Batteries	Cinetrix		Some set lighting on location			Used on the beach. Use and consumption data not available.
Biofuels / Renewable diesel	n/a	n/a	n/a	n/a	n/a	n/a
Hydrogen	n/a	n/a	n/a	n/a	n/a	n/a

** Grey cells indicate no data available

Los Angeles Production 6

Region	Production	Year	Timeline	Total Emissions (MT CO2e)
Los Angeles / Manhattan Beach	GSG Client	2019-2020	Oct 2019 - Mar 2020	398.00

Studio, Location, Production Notes:

Television series. Data from one season.
96 shoot days, 4 on location. Shot in Manhattan Beach, California

Power Source	Consumption	Emissions (MT CO2e)	Specific Applications	Peak demand profile	Use / Runtime	Notes
Utilities (kWh)	472,979.00	167.00	Production Office, Stages		Total	RECs were purchased. Facility electricity and backlot fuel oil included in emissions value.
Grid tie-ins (kWh)	37,520.00	7.54	Backlot, basecamp		Total	Backlot power drop installed in October 2019 for the production.
Generators (diesel) (L)	90.85	0.28	Generators		Total	Specific emissions calculated using albert
Generators (gas) (L)						
Vehicles (diesel) (L)	33,842.47	105.65	Vehicles, trucks, transport, etc.		Total	Vehicle types are aggregated
Vehicles (gas) (L)	34,108.15	95.37	Vehicles, trucks, transport, etc.		Total	Vehicle types are aggregated
Other volume (diesel) (L)						
Other volume (gas) (L)						
Fuel Oil (backlot)	\$3,248.90	Included in Utilities emissions.				

** Grey cells indicate no data available

Los Angeles Production 6, cont.

Region	Production	Year	Timeline	Total Emissions(MT CO2e)
Los Angeles / Manhattan Beach	GSG Client	2019-2020	Oct 2019 - Mar 2020	398.00

Studio, Location, Production Notes:

Television series. Data from one season.
96 shoot days, 4 on location. Shot in Manhattan Beach, California

Clean/Alternative Power	Used (Type(s))	Consumption	Specific Applications	Energy Savings	Emissions Savings (metric tonnes of CO2 equivalent, MT CO2e)	Notes
Solar/Other RE						
Mobile Batteries	Portable Electric VOLTstack 5K and 13K	"675 kWh (13K) 560 kWh (5K)"	Basecamp trucks, set builds in the backlot	"120 Gal diesel avoided by 13K 16 Gal diesel avoided by 2x5K"	"2,679 lb CO2 for 13K avoided 659 lb CO2 for 2x5K avoided"	New technology at the time. Expenses underwritten by production studio. 2x 5K and 1x 13K (max output power 8,025 W for 13K)
Biofuels / Renewable diesel	RD	1,572 Gal	Trucks		15.94 emitted, compared to 18.58 if regular diesel had been used. 2.64 MT CO2e avoided.	Inconvenient to refuel trucks sometimes.
Hydrogen	n/a	n/a	n/a	n/a	n/a	n/a

** Grey cells indicate no data available



APPENDIX 2

2. Clean Power Opportunities with Other Sectors: Research and Engagement

2A. Food Trucks	p. 25
2B. Events	p. 26
2C. Landscaping	p. 27
2D. Construction	p. 28

See Appendix 8 for Key Informant Interview Sources

2A. Food Trucks

Food Trucks	
Current State	"Events serviced by food trucks are typically fairgrounds, community parks, or urban parking lots. These areas do not currently allow trucks to plug in. For food trucks, mobility is key. Vendors almost always bring their own power and use small diesel generators. Generator power needs depend on the type of activity on the truck and its anticipated power draw. In Vancouver, there are some curbside power opportunities available and in development for food trucks."
Fossil Fuel Generators	"Small, Honda 2000 W (12A) gas-powered generators brought by the vendors, usually one generator per user as needed. Some trucks have generators built in, and others use propane for cooking appliances rather than generators for power. Used for fridges/freezers (low draw) and cooking appliances (high draw). For example, at a large Farmers Market with 60-70 vendors, there will be about 10 generators typically brought on site."
Mobile Batteries	Very few vendors use batteries, as they are viewed as cost prohibitive. Daily battery rentals are typically 33% higher than equivalently- powered generators (2kW and 6kW specifically).
Solar/Other RE	Very few vendors use solar panels, they are viewed as cost prohibitive and not always sufficient to address their power needs.
Alternative Fuels	No usage reported.
Grid tie-in-ins	Available in a limited number of locations, especially linked to Farmers Markets. City of Vancouver is increasing curbside power availability in food truck permit spots. Other municipalities were not engaged on this topic.
Future Power Needs	"Portability and/or access in key locations is important. grid tie-in-ins or more affordable batteries can help encourage their use. Some of their space/location need overlap with Farmers Markets and film uses on a limited basis. "
Potential Overlap with Motion Picture Power Needs	"Where food trucks are brought in for catering there can be overlap. Otherwise, food trucks attend festivals and events that do not typically overlap with high-use filming locations. Both film and food trucks can use mobile batteries in place of smaller generators (i.e. 200 W generators, Honda ""putt- putts""). If there is curbside power for food trucks, film may also be able to use it for specific set power needs, however curbside power locations are less likely to overlap with power hungry circus parking locations. Food trucks are often present at events, so if event spaces are electrified then food trucks would be able to access that power as well. However, some food trucks have generators built into their vehicle, which would make changing the power source difficult."

2B. Events

Events	
Current State	Power needs for events vary based on the size of the event, and the power source varies based on the event location. Certain venues such as convention centres and museums provide grid power access to events. Otherwise, events use gas and diesel generators with a range of power capabilities. Larger events are increasingly investing in mobile batteries and solar power, and event organizers are seeking opportunities to access grid power, especially in frequently-used locations.
Fossil Fuel Generators	"Mostly small 4-stroke gas or diesel generators used for ticketing, washrooms, food trucks. Larger events with food production, lighting, and music will have some larger generators as well."
Mobile Batteries	Larger events are investing in mobile batteries, especially if they have strong sustainability mandates.
Solar/Other RE	Larger events are investing in solar, especially if they have strong sustainability mandates.
Alternative Fuels	No usage reported.
Grid tie-in-ins	Available at specific venues (e.g. Vanier Park for Bard on the Beach), depending on the event.
Future Power Needs	More grid access is desired, especially in regularly used areas. Many frequently used locations were identified, as well as major events. Infrastructure upgrade projects such as Northeast False Creek have been identified as potential sites for increased grid tie-in access. Internationally, there is a framework being developed for events to track and disclose emissions, and with disclosure comes actions to reduce, so clean power access for events is an increasingly important topic that will need to be considered in future grid upgrades and cleantech development support. Resources include the Regional Destination Development Council and the Sustainable Events Standard from the Global Events Industry Council (an "association of associations" for events).
Potential Overlap with Motion Picture Power Needs	"On occasion, some high-use event areas may overlap with spaces used by the film industry, indicating some potential for shared grid tie-in-in use. However, film basecamp/circuses usually park on lots out of the way, whereas events usually take place in central locations. For example, Jericho Beach and Spanish Banks in Vancouver (Parks) have been identified as both event spaces and film spaces; however, the locations where power is needed may be different (parking lot for film circus versus park area for event facilities). Mobile batteries are useful for both film and events and there is already overlap as they are both markets for battery manufacturers."

2C. Landscaping

<i>Landscaping</i>	
Current State	Generators are typically not used by landscapers. Landscaping equipment is primarily gas-powered, though landscapers are seeing a rapid increase in availability of battery-powered equipment. There is excitement over electric pickup trucks, which can charge landscaping equipment as well. Future needs were not reported, but respondents presumed that charging stations for battery-powered equipment will be required.
Fossil Fuel Generators	No usage reported.
Mobile Batteries	"Specifically battery-powered equipment (lawn mowers, weed whackers). Some excitement about electric trucks"
Solar/Other RE	No usage reported.
Alternative Fuels	No usage reported.
Grid tie-in-ins	No usage reported.
Future Power Needs	Charging locations for battery-powered equipment were noted to be of potential interest, especially for areas requiring regular maintenance. Mobile battery or curbside power may come to serve this purpose.
Potential Overlap with Motion Picture Power Needs	No overlap identified.

2D. Construction

Construction	
Current State	All sizes of diesel generators are used on lots to power trailers and for other charging needs on a temporary basis. Most heavy-duty equipment and transport is diesel-powered. Particularly with urban construction projects, teams tie into the grid as soon as grid power becomes active and accessible. Future directions include more electric equipment options, as well as hydrogen fuel cells. No use cases for these were reported in Metro Vancouver.
Fossil Fuel Generators	All sizes of diesel generators - 600A - 21,000A (100kW up to 3.5 MW). Used for temporary power on sites before grid access is live, or on remote sites for construction teams or clients.
Mobile Batteries	Some use cases and examples are provided by Portable Electric battery suppliers to power construction equipment.
Solar/Other RE	No usage reported, but solar panels can be observed at construction sites.
Alternative Fuels	Some natural gas generators are installed for clients, but not usually used on construction lots.
Grid tie-in-ins	Building project equipment ties into the grid as soon as it becomes live on their construction site.
Future Power Needs	There is interest in more electric equipment options, as well as hydrogen fuel cell heavy-duty vehicles and equipment.
Potential Overlap with Motion Picture Power Needs	No significant or consistent overlap identified. However, advances in temporary power for the construction industry (e.g. Hydrogen fuel cells in the UK) are anticipated to help scale clean power options for other industries including film.



APPENDIX 3

3. Clean Power and Alternative Fuels: Global Case Studies

3A. Mobile Batteries: Netflix Virgin River Season 4 & Metro Vancouver Productions	p. 30
3B. Renewable Diesel on Production, MBS Equipment Company (Metro Vancouver)	p. 30
3C. City of Vancouver Grid Tie-in Power Kiosks	p. 31
3D. City of Vancouver Art Gallery (VAG) Grid Tie-ins	p. 32
3E. Green Hydrogen on Netflix TV series Bridgerton Season 2	p. 32
3F. Green Hydrogen on BBC Winterwatch	p. 33
3G. Green Hydrogen on BBC Springwatch	p. 33
3H. Green Hydrogen in Construction (UK)	p. 34
3I. VOLTstack Portable Batteries, Shattered Prism (NYC)	p. 35
3J. VOLTstack Portable Batteries, Portable Electric (California)	p. 35
3K. Renewable Diesel on Productions, Netflix (Various Locations)	p. 36
3L. Renewable Diesel on Jurassic World: Dominion (UK)	p. 36
3M. Film London Grid Project (UK)	p. 37

3A. Mobile Batteries: Virgin River Season 4 & other Metro Vancouver Productions

<i>Mobile Batteries on Virgin River Season 4 and other Metro Vancouver Productions</i> link	
Source	Netflix, stakeholder interview
Industry	Film/TV
Region	Metro Vancouver
Timeframe	FY 2021
Funding Source	Private - Netflix productions
Alternative Power	Portable Batteries
Methods/Capacity	Various sizes, unspecified
Application	Used as portable and backup power for equipment trucks, crew catering, overnight power requirements, small shooting units or ancillary lighting setups.
Displacement	Diesel Generators
Cost	NA
Emissions Reduction	20% fuel consumption reduction on the series production. All pilots "resulted in an estimated fuel savings of roughly [52,245 litres] of diesel and 148 MTCO ₂ ." (page 15) Actual emissions reduced and avoided from all portable batteries are 85 MT CO ₂ e (page 16)
Notes	Comments from page 15: "We found that mobile batteries successfully reduced the number of generator hours and in some cases replaced daily generator rentals. Electric battery pilots reduced generator fuel consumption by about 20%. The units are silent compared to diesel generators, so cause no disruption and can be placed close to set"

3B. Renewable Diesel on Production

<i>Renewable Diesel on Production, MBS Equipment Co. (Metro Vancouver)</i>	
Source	MBS Equipment Co. Suncor/PetroCanada
Industry	Film/TV
Region	Metro Vancouver
Timeframe	Jan 2020 - April 2021
Funding Source	Private - production studio
Alternative Power	Renewable Diesel
Methods/Capacity	Drop-in fuel to blend with or replace diesel
Application	NA

3B. Renewable Diesel on Production, cont.

<i>Renewable Diesel on Production, MBS Equipment Co.</i>	
Displacement	Diesel Fuel consumption. Consumed 174,196L of RD-100 instead of regular diesel
Cost	RD-100 rates negotiated for pilot project were cost competitive, though RD-100 currently priced at a premium with limited availability in Metro Vancouver
Emissions Reduction	Unknown. 20-90% potential life cycle reduction, depending on feedstock
Notes	Price for RD-100 is competitive in regions with Low-carbon fuel standards (e.g. California). Premium in other regions, including BC

3C. City of Vancouver Grid Tie-in Power Kiosks

<i>City of Vancouver Grid Tie-in Power Kiosks</i>	
Source	City of Vancouver website and stakeholder interview
Industry	Film/TV
Region	City of Vancouver
Timeframe	2008-ongoing (analysis started in 2008, installation started in 2020)
Funding Source	Public, recovered by film permit fees
Alternative Power	Grid Power
Methods/Capacity	Over time, the City will be installing power kiosks of various amps at 25 key filming sites, particularly where unit base/ circuses are usually parked. 3 were supposed to be installed in 2020, but first and second install are going in for 2022 (including Northeast False Creek). The city aims to have a power kiosk within 10 minutes of any film location in the city over the next five years.
Application	Power kiosks
Displacement	Diesel and Gas Generators of all sizes
Cost	There is no ROI from the power drops themselves, but it is a marketing advantage for film/TV, and a public relations benefit. 400 amps is very expensive to install, but 100-200 amps is more cost-effective. Depending on location needs, costs per power kiosk vary between \$150K - \$400K. Estimated total cost of 2-3 million dollars into the project.
Emissions Reduction	It is estimated that when built, these power kiosk sites: "1/3 of the number of generators used could be displaced. Can be the catalyst for the broader adoption of other clean energy technology that will drive down the remaining 2/3 of generator use in random and less frequently used areas" - City of Vancouver website
Notes	20-30% of film permits are issues under the Clean Energy Incentive, and the goal is to get the industry off diesel generators by 2030. There is some crossover with events, but most filming circuses are located away from foot traffic areas, whereas event locations are central.

3D. City of Vancouver Art Gallery grid tie-ins

<i>Vancouver Art Gallery (VAG) Grid Tie-ins</i>	
Source	Location Fixer, stakeholder interview
Industry	Film/TV
Region	City of Vancouver
Timeframe	2018-ongoing
Funding Source	Public/Private - Vancouver Art Gallery (VAG)
Alternative Power	Grid Power
Methods/Capacity	Grid tie-ins (Camlock power boxes); 2x 400 amp, 6x 200 amp, and 2x 100 amp connections spread in multiple locations around the Art Gallery. 24h security access
Application	Grid tie-ins for equipment trucks, crew catering, overnight power requirements, large shooting units, all lighting setups, special effects.
Displacement	Diesel and Gas Generators of all sizes
Cost	Low to Competitive Productions charged \$250 per day for the 400 amp, and \$125 for the 200 amp (less than diesel generator rentals).
Emissions Reduction	100% reduction. Currently, no generators are allowed on that site except in special circumstances.
Notes	In 2019, there were 52 tie-in days and 64 generator days. In 2021, there were 159 total use days and no generators. Location Fixer collects data based on bookings of the VAG. Productions will often book all tie-ins, but may not use them all each time

3E. Green Hydrogen on TV series Bridgerton Season 2 (UK)

<i>Green Hydrogen on Netflix TV series Bridgerton Season 2</i>	
Source	Netflix
Industry	Film/TV
Region	UK
Timeframe	Season 2, discreet period at one undisclosed location
Funding Source	Private - Netflix
Alternative Power	GeoPura - Green Hydrogen
Methods/Capacity	Continuous power source
Application	Production power (set or basecamp unknown)
Displacement	Multiple Diesel Generators
Cost	NA

3E. Green Hydrogen on TV series Bridgerton Season 2, cont.

Green Hydrogen on Netflix TV series Bridgerton Season 2

[Link](#)

Emissions Reduction	22 metric tonnes CO2e in Hydrogen Solutions (ESG report page 16), as well as NOx, CO and PM
Notes	Successful pilot. Plans to expand on more UK productions AND facilities in 2022. Netflix 2021 ESG Report, pgs 15 - 16

3F. Green Hydrogen on BBC Winterwatch

Green Hydrogen on BBC Winterwatch

[Link](#)

Source	BBC
Industry	Film/TV
Region	UK
Timeframe	2 weeks on-site
Funding Source	Public - BBC
Alternative Power	"GeoPura - Green Hydrogen"
Methods/Capacity	Continuous power source
Application	Powered the outdoor broadcast (OB) hub at BBC Bristol
Displacement	Large Diesel Twinset Generators
Cost	NA
Emissions Reduction	"One live episode of Winterwatch avoided 3.3 tonnes of carbon emissions", as well as NOx, CO and PM
Notes	A key element of success for this project is that the Outdoor Broadcast (OB) station is stationary, allowing these large H2 units to be used as they are not portable.

3G. Green Hydrogen on BBC Springwatch

Green Hydrogen on BBC Springwatch

[Link](#)

Source	BBC
Industry	Film/TV
Region	UK
Timeframe	3 weeks on-site, 12 live broadcasts
Funding Source	Public - BBC

3G. Green Hydrogen on BBC Springwatch, cont.

Green Hydrogen on BBC Springwatch

[Link](#)

Alternative Power	GeoPura - Green Hydrogen
Methods/Capacity	Continuous power source
Application	Powered the OB hub at BBC Bristol
Displacement	Large Diesel Twinset Generators
Cost	NA
Emissions Reduction	7 tonnes of CO2 [emissions avoided] in addition to other air pollutants such as NOx and particulates.
Notes	A continuation of the Winterwatch pilot (see 4F).

3H. Green Hydrogen in Construction (UK)

Green Hydrogen in Construction (UK)

[Link](#)

Source	GeoPura/Cadent
Industry	Construction
Region	UK
Timeframe	20 year regeneration program
Funding Source	Private - Construction partnerships
Alternative Power	GeoPura - Green Hydrogen
Methods/Capacity	Welfare cabins on construction sites
Application	Powered the outdoor broadcast (OB) hub at BBC Bristol
Displacement	Large Diesel Generators
Cost	NA
Emissions Reduction	"Estimated that this ...will prevent circa 19,000 kg of CO2 and other harmful emissions"
Notes	Hydrogen Power Unit (HPU) will be used to provide power to wellness cabins until grid access is available.

3I. VOLTstack Portable Batteries, Shattered Prism (NYC)

<i>VOLTstack Portable Batteries, Shattered Prism (NYC)</i>	
Source	Shattered Prism
Industry	Film/TV, Events, Construction, Disaster Relief
Region	New York City
Timeframe	Various productions, events, food trucks, construction
Funding Source	Private - Various Productions
Alternative Power	Portable Batteries, Solar Charging
Methods/Capacity	Various sizes: 2k, 5k, 60k adapter, 20k coming soon
Application	Portable and backup power for equipment trucks, crew catering, overnight power requirements, small shooting units or ancillary lighting setups
Displacement	Smaller Diesel and Gas Generators, Some Large Diesel Generators
Cost	Competitive
Emissions Reduction	Varies on application and duration
Notes	100% emissions avoided as compared to generators. Working with studios to understand usage and data on how much power they supplied on set. Great use case on recent Star Wars show.

3J. VOLTstack Portable Batteries, Portable Electric (Calif.)

<i>VOLTstack Portable Batteries, Portable Electric (California)</i>	
Source	Portable Electric
Industry	Film/TV, Events, Construction, Emergency Services, EV Charging
Region	BC, other regions through retail partnerships
Timeframe	Various productions, events, food trucks, construction
Funding Source	Private - Various Productions
Alternative Power	Portable Batteries, Solar Charging
Methods/Capacity	Various sizes: 2k, 5k, 20K, 30K
Application	Portable and backup power for equipment trucks, crew catering, overnight power requirements, small shooting units or ancillary lighting setups
Displacement	Smaller Diesel and Gas Generators, Some Large Diesel Generators
Cost	Competitive or Premium
Emissions Reduction	Varies on application and duration
Notes	Great use cases on James Bond 'No Time to Die' and Burning Man festival

3K. Renewable Diesel on Various Productions, Netflix

<i>Renewable Diesel on Productions, Netflix (various locations)</i>	
Link	
Source	Netflix
Industry	Film/TV
Region	Los Angeles, Vancouver, London
Timeframe	FY 2021
Funding Source	Private - Netflix
Alternative Power	Renewable Diesel
Methods/Capacity	Drop-in fuel to blend with or replace diesel
Application	Generators and vehicles
Displacement	Diesel Fuel consumption
Cost	NA
Emissions Reduction	Across three locations consumed [289,917 litres] of RD over fossil fuel diesel in 2021 (page 15); Associated emissions avoided are 717 MT CO ₂ e (page 16)
Notes	Los Angeles and Vancouver have LCFS regulations which incentivizes alternative fuels. Renewable diesel is known as HVO (hydrotreated vegetable oil) in the UK.

3L. Renewable Diesel on Jurassic World: Dominion (UK)

<i>Renewable Diesel on Jurassic World: Dominion (UK)</i>	
Link	
Source	Universal/Amblin
Industry	Film/TV
Region	UK
Timeframe	18-month project, mostly shot in Pinewood Studios UK, but brought RD on location
Funding Source	Private - production studio
Alternative Power	Renewable Diesel
Methods/Capacity	Drop-in fuel to blend with or replace diesel
Application	Diesel generators
Displacement	Diesel Fuel consumption
Cost	NA

3L. Renewable Diesel on Jurassic World: Dominion (UK)

Renewable Diesel on Jurassic World: Dominion (UK)

Link	
Emissions Reduction	NA
Notes	70% life cycle reduction. Interview is with Louise Smith, Neptune Environmental Services

3M. Film London Grid Project (UK)

Film London Grid Project (UK)

Link	
Source	Film London/BFI, stakeholder interview
Industry	Film/TV
Region	UK
Timeframe	Funding process started 2018, many delays. First power drop to be installed 2022. At version 15 of the design.
Funding Source	Interreg Europe, Mayor of London office, Good Growth Fund, Film London. Stipulations about co-benefits with events, as well as industry training and education
Alternative Power	Grid Power
Methods/Capacity	Installing power kiosks of various amps (maximum 200kVA amped down to 315 amps and lower loads for events & food trucks) at 2-3 key filming sites, particularly where unit base/ circuses are parked. Ensured film location needs overlapped usage with events (i.e. parcs which are busy, easy to access, easier than busy streets).
Application	Power kiosks/ Cabinet
Displacement	Diesel and Gas Generators of all sizes
Cost	Victoria Park's budget comes to nearly 594,000 GBP. Capital works in itself costs 373,000 GBP, including contingency cost. Most costs come from the trenching and upgrading, as well as power costs, not from the kiosk itself (est. 50,000 GBP).
Emissions Reduction	Emissions reductions will be calculated over time. Reduction estimates from ARUP: "Detailed analysis completed by ARUP for Victoria Park estimated that during 2018, production generators consumed 64,082 litres of diesel and 1,656 litres of petrol. The estimated CO2 emitted by the generators was 169,556kg." - Film London, Mar 24, 2022
Notes	Currently, Film London is collecting emissions and use data from all productions on the future site of the power kiosk, so they have some baseline to compare to. The kiosk will be metered.



APPENDIX 4

4. Top Filming Locations in Metro Vancouver

4A. Total Filming Days by Metro Vancouver Municipality	p. 39
4B. Top Filming Locations within Municipalities	p. 41
4C. Studio Blocks/Facilities and Locations	p. 42
4D. Municipalities Survey	p. 44

4A. Total Filming Days: Municipalities

2021 Filming Days Data Provided by Creative BC
of Stages accessed May 2022 on the Creative BC website

<i>Jurisdiction</i>	<i># Total Days</i>	<i># of Location Days</i>	<i># of Studio Days</i>	<i># of Stages</i>	<i># of Generators Estimated (assume 3 per Location Day)</i>
Village of Anmore	1	1	0	0	3
Bowen Island Municipality	17	17	0	0	51
City of Burnaby	201	201	0	16	603
City of Chilliwack	23	23	0	0	69
City of Coquitlam	231	150	81	1	450
City of Delta	162	141	21	1	423
Village of Harrison Hot Springs	13	13	0	0	39
City of Langley	125	59	66	2	177
Township of Langley	2220	1724	496	0	5172
Village of Lions Bay	7	7	0	0	21
City of Maple Ridge	355	355	0	1	1065
Metro Vancouver	244	244	0	0	732
City of Mission	82	82	0	0	246
City of New Westminster	76	76	0	0	228
City of North Vancouver	112	112	0	2	336
District of North Vancouver*	217	217	0	0	651
Village of Pemberton	1	1	0	0	3
City of Pitt Meadows	182	160	22	1	480
City of Port Coquitlam	30	30	0	0	90
City of Port Moody	58	58	0	0	174
City of Richmond	116	116	0	3	348
District of Squamish	15	15	0	0	45
City of Surrey	435	435	0	4	1305
University of British Columbia (Electoral Area A)	57.5	57.5	0	0	172.5
City of Vancouver	972	972	0	7	2916

* The City and Township of North Vancouver were not differentiated in MapMe, so totals encompass both regions.

** The Village of Belcarra was identified in MapMe, but did not report filming days to Creative BC.
Data points may be on private property, and thus not included in municipal filming reports.

4A. Total Filming Days: Municipalities, cont.

2021 Filming Days Data Provided by Creative BC
 # of Stages accessed May 2022 on the Creative BC website

<i>Jurisdiction</i>	<i># Total Days</i>	<i># of Location Days</i>	<i># of Studio Days</i>	<i># of Stages</i>	<i># of Generators Estimated (assume 3 per Location Day)</i>
Vancouver Parks	172	172	0	0	516
District of West Vancouver	166	166	0	0	498
Resort Municipality of Whistler	84	84	0	0	252
City of White Rock	3	3	0	0	9
Village of Belcarra**	NA	NA	NA	NA	NA
TOTAL IN BC	6,678	5,992	686	38	17,975
TOTAL IN METRO VAN	6,160	5,474			16,421

* The City and Township of North Vancouver were not differentiated in MapMe, so totals encompass both regions.

** The Village of Belcarra was identified in MapMe, but did not report filming days to Creative BC.

Data points may be on private property, and thus not included in municipal filming reports.

4B. Top Filming Locations within Municipalities

Jurisdiction	Location	Number of Filming Days in 2021	Number of Generators Reported Since 2019	Clean Energy Comment
Township of Langley	256 St & 24 Ave	NA	4	No location information was available from the Township of Langley via Creative BC, email, nor interview.
City of Vancouver*	Concord Pacific Lot, 88 Pacific Boulevard	75+	110	Site has been approved for power kiosk installation Power Kiosk Approved Phase 1, Wishlist.
	Victory Square, 200 West Hastings	50-75	56	Wishlist
	Shaughnessy Park	25-50	38	Wishlist (specifically Hycroft Manor)
	Hastings & Thurlow	25-50	28	
	W Cordova St. & Carrall St.	25-50	21	Wishlist
	1300 The Crescent (south of Shaughnessy Park)	25-50	17	
	Oxford Properties, Burrard at W. Cordova	25-50	12	Wishlist
	37th Ave adjacent to Van Dusen, 1192 37th Ave. Van Dusen Parking Lot	<25	1	
City of Surrey	Cloverdale Fairgrounds, 17607-17905 62 Ave, Surrey, BC	125	2	"Wishlist (Cloverdale Rodeo) Nearby Bill Reid Millenium Amphitheatre has a grid tie-in "
	176 St & 57 Avenue	66	0	
	10665 University Drive (Whalley Athletic Park)	60	0	Wishlist
City of Maple Ridge	23588 Jim Robson Way	~100	0	
	Maple Ridge Baptist Church - 22155 Lougheed Highway	60-70	5	
	Memorial Peace Park - 11995 Haney Place	60-70	5	BC Hydro Assessed - low potential for grid upgrade. Existing grid tie-in, though reportedly underutilized by productions.

*Vancouver does not have site-specific numbers, but recommended a distribution of sites with 25/50/75+ filming days with most sites being in the 25-50 range. Which is one every week or two, a lot of volume for one site, especially in smaller jurisdictions. Distributing Vancouver site estimates based on these numbers.

4B. Top Filming Locations within Municipalities

<i>Jurisdiction</i>	<i>Location</i>	<i>Number of Filming Days in 2021</i>	<i>Number of Generators Reported Since 2019</i>	<i>Clean Energy Comment</i>
Metro Vancouver	Capilano River Regional Park	57	4	Wishlist
	Belcarra Regional Park	43	0	
	Lower Seymour Conservation Reserve	29	5	
	Derby Reach	25	0	
	Widgeon Marsh Conservation Reserve	23	4	

*Vancouver does not have site-specific numbers, but recommended a distribution of sites with 25/50/75+ filming days with most sites being in the 25-50 range. Which is one every week or two, a lot of volume for one site, especially in smaller jurisdictions. Distributing Vancouver site estimates based on these numbers.

4C. Studio Blocks

<i>Studio/Facility</i>	<i>Studio Type</i>	<i>Address</i>	<i>City</i>
Bridge Studios	Purpose-built	2400 Boundary Rd.	Burnaby
Canadian Motion Picture Park (CMPP)	Purpose-built	8085 Glenwood Dr.	Burnaby
Eagle Creek Studios	Purpose-built	4210 Phillips Ave	Burnaby
CMPP	Converted	8085 Glenwood Dr.	Burnaby
Mammoth Studios	Converted	2880 Underhill Ave	Burnaby
MBSE Canada Studios	Converted	8301 Eastlake Dr	Burnaby
Norco Studios	Converted	7950 Enterprise St	Burnaby
Whites Studios - Creekwood Flex Space	Converted	38919 Still Creek Avenue	Burnaby
Whites Studios - Lakewood Flex Space	Converted	3690 Bainbridge Avenue	Burnaby
MBSE - Byrne	Converted	5300 Byrne Road	Burnaby
MBSE - Kingsland	Converted	6100 Kingsland Drive	Burnaby
MBSE - McConnell 1	Converted	4082 McConnell Court	Burnaby
MBSE - McConnell 2	Converted	4091 McConnell Court	Burnaby
MBSE - Northbrook	Converted	8820 Northbrook Court	Burnaby
MBSE - Riverbend	Converted	8355 Riverbend Court	Burnaby
MBSE - Winston	Converted	7588 Winston Street	Burnaby
RGA Film Studios	Converted	6150 Lougheed Hwy.	Burnaby
MBSE - North Bend	Converted	96 North Bend	Coquitlam

4C. Studio Blocks, cont.

<i>Studio/Facility</i>	<i>Studio Type</i>	<i>Address</i>	<i>City</i>
MBSE - Derwent	Converted	1420/1440 Derwent Way	Delta
Martini Film Studios	Converted	9390 - 198th Street	Langley
Lumiere Studios	Converted	20329 Logan Ave	Langley
The Ridge Studios	Converted	22366 119 Ave	Maple Ridge
North Shore Studios	Purpose-built	North, 555 Brooksbank	North Vancouver
MBSE Golden Ears	Converted	Ave 19055 Airport Way	Pitt Meadows
Whites Studios - Copperwood	Converted	12211 Horseshoe Way	Richmond
Whites Studios - Fraserwood	Converted	22031 Fraserwood Way	Richmond
MBSE - Jacobson	Converted	12111 Jacobson Way	Richmond
Whites Studios - Riverwood Flex	Converted	18788 - 96 Avenue	Surrey
Space MBSE - Surrey Studio City	Converted	12091 - 88th Avenue	Surrey
Vancouver Film Studios	Purpose-built	3500 Cornett Rd	Vancouver
Manitoba Studio	Converted	8275 Manitoba St.	Vancouver
Pacific National Exhibition	PNE	2900 E. Hastings St.	Vancouver
Whites Studios - Ironwood	Converted	888 SE Marine Drive	Vancouver
MBSE - Kent	Converted	870 West Kent	Vancouver

4D. Municipalities Survey

Municipality	Is your municipality exploring opportunities to implement incentives in the next 3-5 years to encourage film/TV productions to use or access clean power?	Please Describe: OR What challenges are holding back these conversations?	Is your municipality exploring options or currently installing grid power kiosks for film/TV and/or other uses (i.e. food trucks, events, etc.) in the next 3-5 years?	In 2019, Creative BC asked about popular circus parking locations in your municipality. Are there any changes to the list, including new or additional sites to include?	Please note any changes or additions
City of Surrey	Yes	At the moment we charge \$500 for connecting to house power which is roughly a \$700 savings as it costs around \$1,200 per day to rent a generator. We have found that productions are eager to connect to the house power at this cost due to the cost savings, etc.	Yes	No	NA
Resort Municipality of Whistler	No	"Lack of staff resources Not a priority Bylaw for fees and charges amendment - time"	Yes	No	NA
North Vancouver	No	Budgetary concerns	Yes	Yes	Civic Plaza by City Hall
Bowen Island	No	Lack of human resource bandwidth, lack of alternative power infrastructure, lack of budget.	No	Yes	Bowen Island not listed. Not a destination for circuses. :)



APPENDIX 5

5. Scenario Calculations for Estimated Emissions Reduction Potential

5A. Emission Factors Reference p. 46

5B. GHG Emissions Estimates for a Medium Production (budget (\$20 - \$70 million USD))

Diesel Generator p. 49

- Current state, default scenario
- Total GHG emissions: 2.86 tCO₂/day
- Case study provided by a Metro Vancouver generator operator

Biodiesel and Renewable Diesel p. 49

- Replace all diesel in generators with 100% biodiesel or renewable diesel (B100 or R100)
- Total GHG emissions: 0.129 tCO₂e/day
- 95% emissions reduction compared to diesel generators

Grid Tie-ins p. 50

- Displace all generators using grid tie-ins
- Total GHG emissions: 0.016 tCO₂e/day
- 99% emissions reduction compared to diesel generators

Battery Power Stations p. 50

- Displace all generators using battery power stations
- Total GHG emissions: 0.020 tCO₂e/day
- 99% emissions reduction compared to diesel generators

Mixed Scenario p. 51

- Displace the circus generator with a grid tie-in. Displace remaining diesel fuel with renewable diesel (R100)
- Total GHG emissions: 0.103 tCO₂e/day
- 96% emissions reduction compared to diesel generators

5A. Emission Factors Reference

Emission Factors		Source
Diesel	2.7E-03 tCO ₂ e/L	<ul style="list-style-type: none"> Table 1: https://www2.gov.bc.ca/assets/gov/environment/climate-change/cng/methodology/2020-pso-methodology.pdf
Biodiesel (B100)	1.22E-04 tCO ₂ e/L	<ul style="list-style-type: none"> see calculation below
Renewable Diesel (R100)	1.22E-04 tCO ₂ e/L	<ul style="list-style-type: none"> treat the same as biodiesel (B100) - see notes on page A48.
BC Hydro	9.7E-06 tCO ₂ e/kWh	<ul style="list-style-type: none"> https://www2.gov.bc.ca/gov/content/environment/climate-change/industry/reporting/quantify/electricity
Battery Efficiency (lithium-ion)	0.8	<ul style="list-style-type: none"> Roberson, D. et. al. May 2014. <u>Performance Assessment of the PNM Prosperity Electricity Storage Project A Study for the DOE Energy Storage Systems Program</u>. SAND2014-2883. https://mdpi-res.com/d_attachment/vehicles/vehicles-03-00043/article_deploy/vehicles-03-00043.pdf?version=1636007474 https://www.e-education.psu.edu/eme812/node/705

5A. Emission Factors Reference

Biodiesel (B100)	CH4	N2O		Source
Diesel	0.0035	0.0104	kg/GJ	<ul style="list-style-type: none"> Table 1 https://www2.gov.bc.ca/assets/gov/environment/climate-change/cng/methodology/2020-pso-methodology.pdf
GWP	25	298		<ul style="list-style-type: none"> Table 19 https://www2.gov.bc.ca/assets/gov/environment/climate-change/cng/methodology/2020-pso-methodology.pdf
Diesel	0.0383	GJ/L		<ul style="list-style-type: none"> Table 1: https://www2.gov.bc.ca/assets/gov/environment/climate-change/cng/methodology/2020-pso-methodology.pdf
Biodiesel emission factor	1.22E-04	tCO2e/L		

5A. Emission Factors Reference

Notes	
1	<ul style="list-style-type: none"> No change in emission factors reported in 2021 https://www2.gov.bc.ca/assets/gov/environment/climate-change/cng/methodology/2021-best-practices-methodology.pdf
2	<ul style="list-style-type: none"> Biodiesel & Renewable Diesel emissions do NOT include CO₂ - it is considered biogenic (carbon neutral) since the feedstock is organic waste which recently requestered the CO₂ while growing. Renewable diesel is made from the same bio-waste as biodiesel but is processed to be the same as traditional diesel - therefore it is treated the same as biodiesel for GHG emissions.
3	<ul style="list-style-type: none"> Battery efficiency is an estimate from multiple sources, none of which are ideal for the given equipment Battery efficiency (charging/discharging losses) likely only partially account for losses and actual losses will be higher
4	<ul style="list-style-type: none"> Example of battery generator https://portable-electric.com/voltstack-power-stations/voltstack-30k-power-station/
5	<ul style="list-style-type: none"> Example of fuel consumption Vs generator load (figure 1) https://www.researchgate.net/profile/Mohamad-Issa/publication/333110329_Eco-Friendly_Selection_of_Diesel_Generator_Based_on_Genset-Synchro_Technology_for_Off-Grid_Remote_Area_Application_in_the_North_of_Quebec/links/5cf6867e92851c4dd029c930/Eco-Friendly-Selection-of-Diesel-Generator-Based-on-Genset-Synchro-Technology-for-Off-Grid-Remote-Area-Application-in-the-North-of-Quebec.pdf?origin=publication_detail
6	<ul style="list-style-type: none"> Notes on biodiesel and renewable diesel Generator supplier website - any diesel generator can run pure B100 https://sagen.co.za/can-a-diesel-generator-run-on-biodiesel/ Biodiesel is more corrosive - results in higher maintenance costs for rubber/seals/hoses https://www.gotpower.com/can-use-biodiesel-generator/ biodiesel can gel at 1C or much higher (depending on the feedstock) https://farm-energy.extension.org/biodiesel-cloud-point-and-cold-weather-issues/ Renewable diesel has oxygen removed (as standard diesel does) which is why its less corrosive than biodiesel https://blog.veolianorthamerica.com/biodiesel-vs.-renewable-diesel-are-they-the-same

5B. GHG Emissions Estimates for a Medium Production (budget (\$20 - \$70 million USD))

Diesel Generator (1400 A)											
	Phase A	Phase B	Phase C	Total Amps	Hours/day	kW	kWh	Diesel (L)	L/kWh	EF (tCO ₂ e/L)	tCO ₂ e/day
Typical Circus	100	120	80	300	14	36	504	256.0	0.51	2.70E-03	0.69
Catering	25	5	12	42	8	5	40	98.8	2.45	2.70E-03	0.27
Big Night Exterior	180	320	220	720	8	86	691	240.0	0.35	2.70E-03	0.65
Day Exterior with HMI	90	90	45	225	7	27	189	115.2	0.61	2.70E-03	0.31
Work Trucks	40	10	2	52	7	6	44	87.9	2.01	2.70E-03	0.24
Ritter Fan - set	63	26	26	115	7	14	97	97.5	1.01	2.70E-03	0.26
Craft & COVID Testing	0	42	10	52	13	6	81	163.3	2.01	2.70E-03	0.44
Total GHG Emissions											2.86

Biodiesel (B100) & Renewable Diesel											
	Phase A	Phase B	Phase C	Total Amps	Hours/day	kW	kWh	R100 (L)	L/kWh	EF (tCO ₂ e/L)	tCO ₂ e/day
Typical Circus	100	120	80	300	14	36	504	256.0	0.51	1.22E-04	0.0312
Catering	25	5	12	42	8	5	40	98.8	2.45	1.22E-04	0.0121
Big Night Exterior	180	320	220	720	8	86	691	240.0	0.35	1.22E-04	0.0293
Day Exterior with HMI	90	90	45	225	7	27	189	115.2	0.61	1.22E-04	0.0141
Work Trucks	40	10	2	52	7	6	44	87.9	2.01	1.22E-04	0.0107
Ritter Fan - set	63	26	26	115	7	14	97	97.5	1.01	1.22E-04	0.0119
Craft & COVID Testing	0	42	10	52	13	6	81	163.3	2.01	1.22E-04	0.0199
Total GHG Emissions											0.129

5B. GHG Emissions Estimates for a Medium Production (budget (\$20 - \$70 million USD))

Grid Tie-in											
	Phase A	Phase B	Phase C	Total Amps	Hours/day	kW	kWh			EF (tCO ₂ e/L)	tCO ₂ e/day
Typical Circus	100	120	80	300	14	36	504			9.70E-06	0.00489
Catering	25	5	12	42	8	5	40			9.70E-06	0.00039
Big Night Exterior	180	320	220	720	8	86	691			9.70E-06	0.00670
Day Exterior with HMI	90	90	45	225	7	27	189			9.70E-06	0.00183
Work Trucks	40	10	2	52	7	6	44			9.70E-06	0.00042
Ritter Fan - set	63	26	26	115	7	14	97			9.70E-06	0.00094
Craft & COVID Testing	0	42	10	52	13	6	81			9.70E-06	0.00079
Total GHG Emissions											0.016

Battery Power Station											
	Phase A	Phase B	Phase C	Total Amps	Hours/day	kW	kWh			Grid Charging EF (tCO ₂ e/L)	Grid Charging tCO ₂ e/day
Typical Circus	100	120	80	300	14	36	504			1.21E-05	0.00611
Catering	25	5	12	42	8	5	40			1.21E-05	0.00049
Big Night Exterior	180	320	220	720	8	86	691			1.21E-05	0.00838
Day Exterior with HMI	90	90	45	225	7	27	189			1.21E-05	0.00229
Work Trucks	40	10	2	52	7	6	44			1.21E-05	0.00053
Ritter Fan - set	63	26	26	115	7	14	97			1.21E-05	0.00117
Craft & COVID Testing	0	42	10	52	13	6	81			1.21E-05	0.00098
Total GHG Emissions											0.020
Max kWh for 1 1400amp (168 kW) gen. over 14hr							2352	GHG emissions reduction from diesel			99%

5B. GHG Emissions Estimates for a Medium Production (budget (\$20 - \$70 million USD))

Mixed Scenario		
	Power Source	tCO2e/day*
Typical Circus	Grid Tie-in	0.0049
Catering	Renewable Diesel (R100)	0.0121
Big Night Exterior	Renewable Diesel (R100)	0.0293
Day Exterior with HMI	Renewable Diesel (R100)	0.0141
Work Trucks	Renewable Diesel (R100)	0.0107
Ritter Fan - set	Renewable Diesel (R100)	0.0119
Craft & COVID Testing	Renewable Diesel (R100)	0.0199
Total GHG Emissions		0.103
GHG emissions reduction from diesel		96%

*totals from previous tables for grid tie-ins and R100



APPENDIX 6

6. Policy and Regulatory Mechanisms in Support of Clean Power: Landscape Scan

6A. National and International Benchmarking

Comprehensive Summary Matrix, Film Fund Organisations, part A p. 53

Comprehensive Summary Matrix, Film Fund Organisations, part B p. 55

Comprehensive Summary Matrix, Municipalities / Jurisdictions p. 59

6B. Facilities Survey

p. 61

6A. Comprehensive Summary Matrix, Film Fund Organisations, part A

Film Fund Organisation	Country	Since / Inception	Document	Notes
Creative BC	Canada	2006	Reel Green (TM) Strategic Plan, 2021-24	"Purpose is our north star - it is why Reel Green exists and serves as the focal point we work toward year after year. We hold firm on the vision for a sustainable and thriving industry with a positive and healthy relationship with our environment and society. And every day, we work to advance Reel Green's mission: to accelerate the evolution and implementation of sustainable practices in the motion picture industry to contribute to the betterment of the world."
Telefilm Canada	Canada	2022	Eco-Responsibility Action Plan	The plan aims to lead and support the industry through informed business practices and the establishing of science-based policies and targets. This commitment will be implemented throughout Telefilm's programs, initiatives, promotion and communications efforts, research, training, business practices and HR policies.
CNC (Centre national de la cinématographie et de l'image animée)	France	2020	plan Action ! Pour une politique publique de transition écologique et énergétique dans les secteurs du cinéma, de l'audiovisuel et de l'image animée	Le CNC met en place une politique progressive, en trois phases, qui débute en 2022 et se déploie en 2024.
Ontario Creates	Canada	2013 (2020 started Ontario Green Screen)	Ontario Green Screen Strategic Plan 2021-2023	"This plan lays out specific, measurable and timely goals for the initiative, based on four key pillars: Develop an engaged, diverse and inclusive community that advances and enables sustainable production practices."
BCTQ / QFTC	Canada	2018 (On Tourne Vert created, joined Reel Green)	On tourne vert / Rolling Green	On tourne vert est un plan d'action initié par Québecor, par l'entremise de ses filiales MELS et TVA, ainsi que par le Bureau du cinéma et de la télévision du Québec (BCTQ) en collaboration avec le Conseil québécois des événements écoresponsables (CQEE). Ce plan vise à accélérer le déploiement des productions audiovisuelles écoresponsables au Québec.
Flanders Audiovisual Fund	Belgium	2013	'e-Mission' project	All productions receiving financial support from VAF are obliged to follow an individual coaching, make an action plan containing sustainable choices for the specific project and fill in a VAF-carbon calculator.
Film London/BFI	United Kingdom	2016	GREEN SCREEN ACTION PLAN - FILM LONDON 2020-2021	Many of Film London's Premiere Locations and London Filming Partnership members will offer a 3% - 5% discount on filming fees to those signed up to Green Screen.
Ecoprod	France	2009	ENVIRONNEMENT & CLIMAT. De nouveaux enjeux pour les acteurs de l'audiovisuel	Le collectif comprend des diffuseurs, publics et privés, des structures de soutien à la production, des experts gouvernementaux et l'organisme de prévoyance du secteur.
BAFTA (British Academy Film Awards)/ albert	United Kingdom	2011	Albert Carbon Calculator	"If you're producing for BBC, ITV, Channel 4, UKTV, Sky, TG4 or Netflix, you'll need to calculate your carbon footprint with Albert."

6A. Comprehensive Summary Matrix, Film Fund Organisations, part A, cont.

Film Fund Organisation	Country	Since / Inception	Document	Notes
Green Shoot	United Kingdom	2009	Green Shoot website	Manage the Green Screen program, which is an "educational programme and social enterprise that helps advertising, film and TV productions reduce carbon emissions and costs." Film London works with Green Screen to award permit discounts.
Producers Guild of America	United States	2010	Green Production Guide	The GPG was established in 2010 in a joint effort between the Producers Guild of America Foundation's PGA Green committee and a major studios partner group, now known as the Sustainable Production Alliance (SPA).
Netherlands Film Fund	Netherlands	2015	"greenfilmmaking.com and https://greenmedia.sites.uu.nl/towards-a-sustainable-dutch-film-industry/ "	"Research and pilot projects funded by NFF are currently underway, report to have been delivered by the end of 2021 (https://greenmedia.sites.uu.nl/towards-a-sustainable-dutch-film-industry/). NFF has also partnered with/ facilitated Green Film Making, and Sustainability Manager Els Rientjes since 2015. Productions can hire Rientjes for consulting. In the coming years, NFF will build up an emissions inventory of all their productions with selective funding. "
CineRegio	European Union	2012	CineRegio Green Report 2020	In 2012, a number of Cine-Regio members decided to form the Green Regio subgroup, whose aim is to raise awareness and share knowledge on sustainable film production tools, measures and policies. In 2019, they published and 28 members signed the Manifesto. Determined that Trentino's Green Film rating system was the most robust and should be used by all members, with intent of making it a pan-European certification scheme.
Trentino Film Commission	Italy	2017	Green Film	The Commission's cash reward for respecting environment is based on green points awarded under its GREEN FILM environmental sustainability certification (known as T-Green Film). 33 films certified to date, same number currently in the funding pipeline.
Wallimage	Belgium	"2019 (date of Green Film Wallonia overview)"	Green Film Wallonia	Wallimage has adopted the Green Film initiative, and provides a GREEN FILM Wallonia label for successful productions. Verified and certified sustainable productions are eligible to have their added sustainability costs funded at a rate of 200% by Wallimage. The CineRegio Green Manifesto supports making sustainable policies and means available for the industry. According to interviews with Trentino, Wallimage have made Green Film Certification compulsory.

6A. Comprehensive Summary Matrix, Film Fund Organisations, part B

<i>Film Fund Organisation</i>	<i>Industry data collection, Baseline, Measures progress</i>	<i>Pilot projects, R&D support</i>	<i>Grid connection, infrastructure support</i>	<i>Film permit conditions, regulations</i>	<i>Financial support, funding, incentives</i>	<i>Carbon calculator, carbon estimate and action plan, carbon budget reference</i>	<i>Carbon offsetting resources, requirement</i>	<i>Certification, awards</i>
Creative BC	Data gathering, received from and shared with municipalities		Grid connection, MapMe tool and clean power resources	Not directly, points to permit regulations in Vancouver		albert Carbon Calculator		National Reel Green Certification is in progress - to share with Telefilm
Telefilm Canada	Initiating internal and industry facing baseline data, future steps include measuring progress	Partner research through Ontario Creates and BCTQ, unrelated to cleantech or energy consumption			Not currently. Exploring the development of incentives and financial support for next phase	Exploring requirements for next phase of plan implementation		
CNC (Centre national de la cinématographie et de l'image animée)	Data gathering	R&D support with gov't funding	Support for studio infrastructure retrofit	Film permit conditions	Government financial support until 2030, funding incentives	Carbon calculator, requires carbon footprint, carbon budget reference	Plans to make carbon calculation a requirement next year (2023). No specific tool recommended	Valuation and awards
Ontario Creates	Data gathering, baseline, measures progress	Supporting research efforts, unrelated to cleantech or energy consumption	Grid connections being pursued by municipalities (i.e. City of Toronto), not Ontario Creates		Research efforts only	albert Carbon Calculator, carbon budget reference		Valuation and Awards
BCTQ / QFTC	Data collection	Pilot projects, R&D support, unrelated to cleantech or energy consumption			Research efforts only	albert Carbon Calculator		Certification

6A. Comprehensive Summary Matrix, Film Fund Organisations, part B, cont.

<i>Film Fund Organisation</i>	<i>Industry data collection, Baseline, Measures progress</i>	<i>Pilot projects, R&D support</i>	<i>Grid connection, infrastructure support</i>	<i>Film permit conditions, regulations</i>	<i>Financial support, funding, incentives</i>	<i>Carbon calculator, carbon estimate and action plan, carbon budget reference</i>	<i>Carbon offsetting resources, requirement</i>	<i>Certification, awards</i>
Flanders Audiovisual Fund	Data gathering, baseline, Measures progress			Film permit conditions	Final 10% of funds received once productions submit evidence of sustainable production	Pre Production carbon estimates and action plan, Carbon calculator, requires carbon footprint		Certification
Film London/BFI	Measures progress, engages & feedback to City of London	London GRID Project pilot	"The Grid Project Working on Retrofit research, studio build and materials. Will be available later this year."		Financial incentives	Pre Production carbon estimates and action plan. Will work with any carbon calculator out there	Carbon offsetting	Certification
Ecoprod	Baseline	Industry wide research				Carbon clap carbon calculator		Certification
BAFTA (British Academy Film Awards)/ albert	Collects and aggregates carbon footprint data, summarizes in reports, inward & outward facing research	Creative Energy project in the UK, to help productions source renewable energy. Also recently released the Sustainable Studio Standard	Support through targeted research. 2022 released the Studio Sustainability Standard, for facilities to voluntarily self-assess sustainability			albert Carbon Calculation, Action Plan	Required for certification, provided vetted resource	albert Certification
Green Shoot	Industry data gathering, measures progress					Carbon Calculator, supports carbon reduction strategy throughout production		Green Screen program Certification
Producers Guild of America	SPA will report in industry emissions every 2 years, 1st time in 2021					PEAR carbon calculator		Through external submission to Environmental Media Association

6A. Comprehensive Summary Matrix, Film Fund Organisations, part B, cont.

<i>Film Fund Organisation</i>	<i>Industry data collection, Baseline, Measures progress</i>	<i>Pilot projects, R&D support</i>	<i>Grid connection, infrastructure support</i>	<i>Film permit conditions, regulations</i>	<i>Financial support, funding, incentives</i>	<i>Carbon calculator, carbon estimate and action plan, carbon budget reference</i>	<i>Carbon offsetting resources, requirement</i>	<i>Certification, awards</i>
Netherlands Film Fund	Soon to be initiated	Pilot Projects (through Utrecht University partnership). Pilot study with a NFF funded Eco Manager, and there was interest in having the position.	Through Green Film Making, Harvest Map for clean energy	Considering making an Eco Manager mandatory to receive NFF funds	Have a "carrot" incentive for sustainability, geared toward producers and filmmakers	In the early stages of seeing how to best integrate carbon calculation. Considering international interests and existing resources as well		
CineRegio	Raise awareness, report compiled by Green Film Shooting							Green Film certification (originally developed by Trentino Film Commission)
Trentino Film Commission	Coordinates the Green Film Lab research project. Collect data, map technologies, revise the rating system. Collaborate with Ministry of Culture	Support through the Green Film Lab, significant R&D focused on production activities		Productions receive the final 20% of their funding with the final expense report and evidence of sustainable production	Ministry of Culture Productions can receive up to 5000 Euros in sustainability-based funding Funds (many regional and the national one) are applying incentives to push the efforts of producers toward making their productions more sustainable by receiving the Green Film certification.	Pre Production carbon estimates and action plan		Green Film certification (originally developed by Trentino Film Commission)

6A. Comprehensive Summary Matrix, Film Fund Organisations, part B, cont.

<i>Film Fund Organisation</i>	<i>Industry data collection, Baseline, Measures progress</i>	<i>Pilot projects, R&D support</i>	<i>Grid connection, infrastructure support</i>	<i>Film permit conditions, regulations</i>	<i>Financial support, funding, incentives</i>	<i>Carbon calculator, carbon estimate and action plan, carbon budget reference</i>	<i>Carbon offsetting resources, requirement</i>	<i>Certification, awards</i>
Wallimage				Productions must submit sustainability planning information with their applications, as of January 2021	Extra costs brought on by adopting sustainability practices can be covered by Wallimage funding. Certification means that 200% of sustainability expenses can be covered by Wallimage			GREEN FILM Wallonia label will be distributed to sustainable productions for inclusion in their end labels

6A. Comprehensive Summary Matrix, Municipalities / Jurisdictions

<i>Municipalities / Jurisdictions</i>	<i>Industry data collection, Baseline, Measures progress</i>	<i>Pilot projects, R&D support</i>	<i>Grid connection, infrastructure support</i>	<i>Film permit conditions, regulations</i>	<i>Financial support, funding, incentives</i>	<i>Carbon calculator, carbon estimate and action plan, carbon budget reference</i>	<i>Carbon offsetting resources, requirement</i>	<i>Certification, awards</i>
City of Vancouver	Collects data to inform future locations of power kiosks	None, focus is on getting kiosks installed	Installing 12-15 power kiosks for the film industry by 2030.	At the Vancouver Art Gallery, productions are not permitted to bring generators unless verified to be absolutely necessary. Instead, they must tie in to grid power. Similar requirements are being considered for other sites with clean power.	Productions receive a 50% rebate on daily permits when they eliminate a generator in favour of clean power (i.e. grid power or battery)			Productions are reviewed before receiving a 50% permit rebate
City of Toronto	Collects data to inform future locations of power kiosks	Will collect usage and electricity consumption data from kiosks, share a success story	Installing 2 power drops in 2022 and 2 in 2023. Tie-ins available in City squares.	Will collect usage and electricity consumption data from kiosks, share a success story	Under consideration, but not currently planned. Productions will pay a \$400 administration fee plus their usage, which is lower than a generator rental which incentivizes the change.			
City of London (UK)	Will receive report from Film London to determine success (i.e. emissions avoided) from power kiosk pilots	Film London will collect usage and electricity consumption data from kiosks to share with the City of London.	Film London is installing 2 power kiosks as a pilot study, then sharing learnings so others can install them	Exploring permit conditions for clean power in near future	Will provide a discount for productions to use grid tie-ins.			

6A. Comprehensive Summary Matrix, Municipalities / Jurisdictions, cont.

<i>Municipalities / Jurisdictions</i>	<i>Industry data collection, Baseline, Measures progress</i>	<i>Pilot projects, R&D support</i>	<i>Grid connection, infrastructure support</i>	<i>Film permit conditions, regulations</i>	<i>Financial support, funding, incentives</i>	<i>Carbon calculator, carbon estimate and action plan, carbon budget reference</i>	<i>Carbon offsetting resources, requirement</i>	<i>Certification, awards</i>
Metro Vancouver	Compiles annual report on filming activity including locations and number of filming days		Provides access to grid power on site when available		Provides a 50% film permit rebate for up to 2 days when productions use clean power to replace a minimum of a 400 Amp generator			Productions are reviewed before receiving a 50% permit rebate
City of Surrey	Compiles annual filming days on municipally owned sites as well as private property, though number of filming days in studio is not exact	Focus is on building power kiosks.	Provides access to grid power on municipally owned properties when available, with City Hall being the most popular with a range of 400-600 Amp connections. Currently exploring opportunities to partner with BC Hydro and install grid ties at popular sites, such as the Cloverdale Fairgrounds.	Films must use grid tie-ins on municipal property instead of generators, unless absolutely necessary for verified production needs. Has been consistently successful for 3 years. No other regulations, has eyes on the City of Vancouver.	No formal incentives. Permits are granted for municipally owned sites after negotiation, which includes reductions (usually around \$500-\$1000 daily) based on clean power usage. Also tie-in fees are set lower than comparably-powered generator rentals to incentivize switching to clean energy for savings.			
City of Maple Ridge	Compiles annual permits, but not specific to locations or days. Number of generators are recorded during the inspections and authorizations.			Eyes are on larger municipalities for guidance				

6B. Facilities Survey

<p><i>Studio Facility Company</i></p>	<p><i>Does the facility have a sustainability and/or clean energy policy, guideline, or defined target?</i></p>	<p><i>Does the facility have any internal policies that govern diesel generators and/or fuel use - on location? on your lots?</i></p>	<p><i>If you rent generators, do you have Tier 4 generators?</i></p>	<p><i>Are you investing CapEx in cleantech or other generator fuel reduction technology?</i></p>	<p><i>Do you have any recommendations for how Metro Vancouver's regulatory environment might best align to support your sustainability efforts?</i></p>
<p>MBSE / MBSE Canada</p>	<p>No formal policy about clean energy. Track carbon initiatives compared to a 2021 emissions baseline and currently developing a company-wide GHG reduction target. Have sustainable operating procedures, participate in government and regional engagement.</p>	<p>All equipment has been tested for use with RD, and all generators leave the facility lots with RD.</p>	<p>No. Have 85% Tier 3 generators, and have received feedback the productions won't use Tier 4 generators.</p>		
<p>William F. Whites International</p>	<p>No, facility-based policy is difficult as the facilities are not owned by the company. Waste management policies are in development, but energy is more difficult as it is not directly managed by the company.</p>	<p>No. Whoever rents the generators is responsible for the fuel.</p>	<p>No, but first Tier 4 800 amp generator will come in summer 2022. Have been testing hybrid 100kW battery pack with generator. Will run a test for a Tier 4 generator with a battery pack hybrid.</p>		

6B. Facilities Survey

<i>Studio Facility Company</i>	<i>Does the facility have a sustainability and/or clean energy policy, guideline, or defined target?</i>	<i>Does the facility have any internal policies that govern diesel generators and/or fuel use - on location? on your lots?</i>	<i>If you rent generators, do you have Tier 4 generators?</i>	<i>Are you investing CapEx in cleantech or other generator fuel reduction technology?</i>	<i>Do you have any recommendations for how Metro Vancouver's regulatory environment might best align to support your sustainability efforts?</i>
Vancouver Film Studios	Yes, company sustainability policy and committee in place, energy reduction targets, sustainable energy generation, CSR, B-Corp, Climate Smart	Exterior camlocks in place to eliminate the need for generators on lot, GPS monitoring on generators to log load data and promote reduction in number of diesel generators used on location, electric power plant purchasing program in place.	No, all Tier 3. Tier 4 has been a disaster.	Yes, more than 10% of budget	Install the location power drops we have all been talking about for so long! Also, enable accessibility to bio-diesel through incentives for providers.
Martini Film Studios	Yes, facilities are to be NetZero by the end of 2022. Facilities are connected with Fortis Renewable Natural Gas. Installed a 54kW Solar power farm on the studio roof. Operate a fleet of EVs for studio use, and have 22 Level 2 charging stations throughout facility for use by clients.	Yes - mandated in production agreements that the studio facility is diesel generator free. External backlot powered by BCHydro Summer 2022, therefore generator free.	Not applicable, do not rent generators	No	NA



APPENDIX 7

7. Background Information on Clean Power Alternatives

7A. Grid Tie-ins and Power Kiosks	p. 64
7B. Mobile Battery Power Stations	p. 65
Cost Comparison	p. 67
7C. Green Hydrogen Power	p. 68
7D. Renewable Diesel	p. 69

7A. Grid Tie-ins and Power Kiosks

Background

Jurisdictions in the Lower Mainland are the global leaders in providing grid tie-ins for film and TV productions. Creative BC manages a Grid Power Access Map for productions to use, with over 150 grid tie-ins listed on both public and privately managed properties. A companion resource, the Generator Parking Locations Map, provides jurisdictions with insights about where productions frequently use generators and can help inform decisions about providing further grid power access such as public power kiosks.

The City of Vancouver is in the process of installing power kiosks specifically for productions at popular circus parking locations, with the first kiosk installation beginning in 2022. An additional 2-3 sites will be added each year until 2026. In doing so, the City of Vancouver aims to further eliminate the use of 1400A diesel generators per production with the goal of getting to no fossil fuel generators by 2030. Criteria for site selection include, inter alia, the site's popularity, ease of access and management, and whether there are potential synergies with nearby capital development projects. Following site selection, a BC Hydro assessment is implemented to determine if there is available power that can be accessed on the local circuit. The film industry typically requests 400A cam-lock power connections at these kiosks which presents feasibility challenges due to power availability limitations.

The City of Vancouver has openly engaged with other jurisdictions to share lessons learned from installing power kiosks. The City of Toronto launched power kiosks in 2022, and Film London in the UK has also embarked on a power kiosk project. These jurisdictions continue to collaborate with each other and relevant industry stakeholders to deliver grid power to productions.

Sources

City of Vancouver. [Film production clean power network](#). Web. Accessed Jan. 16, 2023.

[City of Toronto to install two power drops at filming hotspots to help film productions reduce emissions](#). News Release. Sep. 6, 2022

[Film London announces commission of The Grid Project, supplying renewable energy to productions in the capital](#). Mar. 24, 2022.

7B. Mobile Battery Power Stations

Background

Mobile battery power stations are an alternative to fossil fuel generators for portable power. A range of battery sizes from 2 kW (2.7 hp) to 96 kW (128.7 hp) are available in Metro Vancouver from manufacturers and rental companies. One to two 5 kW (6.7 hp) batteries can fully replace generators for smaller power loads. The 96 kW batteries can replace generators for equipment trucks, catering and set lighting, depending on the power needs. These larger units can also be combined with a generator for large power draws. Recent industry research has shown that productions regularly oversupply power by using large generators for low power loads. When generators idle, engines run inefficiently and can become damaged, and harmful air contaminants and GHGs are still emitted.

Currently, low power loads on generators used by the film industry can be fully supplied by small mobile battery power stations. Larger batteries, such as the 96 kW (128.7 hp) units currently available in Metro Vancouver, can be combined with existing generators to reduce overall generator runtime for larger power needs. Additionally, a 1,000A/250 kW hybrid power system is currently in development that designed to provide 12 hours of battery run time. These are still being piloted and both purchasing and rental prices are yet to be determined.

There are numerous benefits to using mobile battery power stations. These include:

- Use in sensitive locations where noise and air contaminant emissions are a concern (e.g. indoors, rural and wilderness areas, next to windows, residential areas)
- Replacing generators for low power draws (e.g. camera equipment, sound equipment, video playback, some set lighting) and non-filming equipment (e.g. washroom trailers, work area lighting, craft truck, work trucks)
- Hybridisation with other power sources for recharging and to reduce generator runtime (e.g. grid power, solar panels, fossil fuel generators)
- Accessing rebate opportunities to balance battery rental costs (e.g. 50% film permit rebate clean energy incentive from City of Vancouver, \$500 Clean Energy Discount from Metro Vancouver)

Sources

Valid Manufacturing. [How to Power your Film Set Efficiently](#). Web. July 13, 2022.

[EcoSilent Green Energy Solutions](#)

An example from Netflix's 2021 [Environmental, Social and Governance](#) report (page 15), showed that using mobile batteries hybridized with fossil fuel generators reduced overall generator hours by 20%.

7B. Mobile Battery Power Stations, cont.

Barriers to Use

The list below provides an overview of barriers and challenges based on respondent feedback and professional experience:

- Cost
 - Batteries are anywhere from 32-400% more expensive to rent than generators, depending on battery and size as well as the vendor.
 - Budgeting is not perceived holistically, meaning that a battery's up-front cost is more expensive than a generator. However, reducing cabling, labour, and fuel costs from avoiding generators help reduce the extra cost of the battery to be more competitive. Clean power rebates in the City of Vancouver and Metro Vancouver Regional Parks also help balance the costs.
- Size/Power output
 - Large, towable batteries currently available on the market are perceived to be unable to fully replace large diesel generators (usually 1200A-1600A) as they do not have the same power capacity. However, in practice, productions are consistently documented to be utilising generators at or below 20% capacity.
 - There is a sense where you don't get enough "bang for your buck", when batteries are pricey and supply less power than a generator.
 - The largest batteries are towable which introduces novel transportation and site logistic challenges, though these are easily addressable.
- Education and Training
 - Gaffers (electricians) and Generator "Genny" operators are unaware of how to best use batteries, or do not yet trust the battery's ability to power set. This challenge is addressed through training, exposure, and word of mouth in the industry.
 - Budgeting is not completed holistically, which means that the fuel savings observed from using batteries are missed or not included by the department responsible for procuring equipment.
 - Production crews work long hours with heavy workloads, so information is difficult to disseminate and training opportunities are limited.
 - Conversations need to happen more regularly between gaffers/electricians and producers to discuss opportunities for cost recovery.
- Recharging
 - Planning the day to include time to swap out or top up batteries introduces a new logistics challenge which is addressed through training and experience. Batteries currently on the market charge within 2-4 hours with a maximum power hookup depending on the battery size.
 - Clean power sources are not always available or accessible, meaning that batteries sometimes get charged using generators. However, this challenge can be addressed using a hybridized battery-generator system. Also, charging a battery uses up more of the generator's power capacity, which means that the fuel is efficiently used.
- Access and availability/supply
 - Availability is mainly a challenge in other jurisdictions. Anecdotally, Metro Vancouver has the largest market for batteries. However, this situation is changing as demand and supply for batteries increase and battery technology improves .
 - Even in Metro Vancouver, there is a limited supply of large, towable battery power. Specifically, there are currently 8 units to service between 40 to 80 productions at any given time of the year.

7B. Mobile Battery Power Stations, cont.

Barriers to Use, cont.

The two main barriers to widespread adoption of mobile battery power stations are limited availability of affordable units, and lack of recharging infrastructure. Currently, rental costs are 32-400% higher than comparable generators. Batteries do lead to cost savings in fuel, and the rental price gap is anticipated to drop in the near future as new battery technologies, sizes and vendors come onto the market. Additionally, hybrid power systems that either connect separate battery and generator units, or hybridize them into one unit, are currently being developed. A hybrid system addresses the current gap in charging infrastructure.

7B. Mobile Battery Power Stations, Cost Comparison

Battery Power Station	Comparable Generator*	Cost Difference**
2.4 kW (3.2 hp) Lithium Ion Battery	2 kW (2.7 hp) Gas Generator	49% more expensive to rent the battery (MBSE)
4.8 kW (6.4 hp) Lithium Ion Battery	7 kW (9.4 hp) Gas Generator	32% more expensive to rent the battery (MBSE)
8.8 kW (11.8 hp) Lithium Ion Battery	6.5 kW (8.7 hp) Gas Generator	368% more expensive to rent the battery (WFW LES)
96 kW (128.7 hp) Lithium Ion Battery	1500 A Standalone Diesel Generator	94% more expensive to rent the battery (MBSE)

*Power outputs differ between available batteries and generators. Where possible, units with similar power outputs were compared. Otherwise, equipment companies provided recommended comparisons.

**Determined using quoted average price differences between batteries and generators rented by the same companies.

7C. Green Hydrogen Power

Background

Hydrogen fuel cells are an alternative to large diesel generators used by the film and TV industry. Hydrogen power has noted potential in a variety of applications in Canada, but has not been used on productions to date. However, it has been successfully used in the construction industry in Europe, and on a number of UK-based film and TV productions. There is potential to use hydrogen power to replace generators on productions in Metro Vancouver.

Green hydrogen refers to hydrogen fuel produced using renewable energy to electrolyse water. Hydrogen fuel can also be produced from other energy sources, including nuclear, natural gas, and coal. Hydrogen power is generated by separating hydrogen molecules to create electricity, with the only additional outputs being water and heat. Using green hydrogen in a fuel cell is preferable because it causes zero lifecycle emissions.

According to interviews, large hydrogen fuel cells are best used for high power draws, such as circus, when the unit can be stationary for multiple days or longer. Size of the units, cost, and availability are currently the key barriers that prevent more widespread use of hydrogen power on film and TV productions in the UK. There is also potential to use hydrogen power in Metro Vancouver for similar applications.

Sources

Natural Resources Canada. [Using hydrogen in Canada](#). Dec. 16, 2020.
National Grid Group. [The hydrogen colour spectrum](#). Accessed Jan 17, 2023.
U.S. Office of Energy Efficiency and Renewable Energy. [Fuel Cells](#). Accessed Jan. 17, 2023.

7D. Renewable Diesel

Background

Renewable diesel (RD, also known as hydrotreated vegetable oil or HVO) has been used on a handful of productions in Metro Vancouver as part of pilot programs to reduce emissions. RD is chemically similar to fossil diesel, which means it performs like fossil diesel and can be used as a drop-in fuel to any diesel engine. It is made from renewable feedstocks such as agricultural and animal byproducts, which can reduce lifecycle emissions (i.e. emissions from manufacturing and processing) between 36-89%. Tailpipe emissions (such as NOX, PM, and CO₂) from RD are marginally less polluting than from fossil diesel, although this factor depends on the fuel feedstock and engine rating.

RD use is growing in North American markets, such as California, that regulate and incentivize RD through a low-carbon fuel standard (LCFS). RD is increasingly present in Metro Vancouver as the City of Vancouver requires it for all non-electric city fleet vehicles. Nationally, Canada is in the process of amending the Clean Fuel Standard (CFS) which is scheduled to be finalised in late 2022 to early 2023. Among other changes, these fuel standards support increased RD blending in the fuel markets.

In Canada, all RD used by the film industry has occurred exclusively in the Metro Vancouver region. In 2021, the total volume of RD sold to the industry was approximately 150,000 L, according to Suncor. This volume was distributed to 5 different customers who were logistically positioned to take advantage of Suncor's Langley-based wholesale distributor. However, the exact emissions savings for productions using RD cannot be calculated as the fuel feedstock is unknown. Netflix reported consuming 348,175.94 litres (76,588 gallons) of RD on productions in Vancouver, Los Angeles, and London, UK in 2021.

Limited access points is a barrier to wider film industry adoption of RD in the Metro Vancouver area. For comparison, the film industry in Metro Vancouver used a conservative estimate of 9.75 million litres of fossil diesel in 2021. In contrast, 150,000 litres of RD represents approximately 1.5% of the total volume of fossil diesel. Awareness and use is slowly growing, with at least three new productions reported to be using RD in 2022 and others currently in negotiation. In addition, Suncor is working to provide RD at a competitive rate through a central distributor in Vancouver in order to better serve film industry needs. The current demand from the film industry is described as very high, but the higher cost of RD remains prohibitive for wide adoption. Despite the forthcoming Canadian CFS, no government subsidisation for RD is anticipated.

Sources

U.S. Environmental Protection Agency. [Lifecycle Greenhouse Gas Results](#). Accessed May 5, 2022. Calculations are for petroleum diesel at 97 kg CO₂e/mmBtu, Distillers sorghum oil RD at 35.4kg CO₂e/mmBtu, and Palm oil RD at 86.7kg CO₂e/mmBtu from the figure.

City of Vancouver. [Greening the City's Fleet](#). Accessed Jan 13, 2023.

Government of Canada. [What are the Clean Fuel Regulations?](#), Jul. 7, 2022.

Netflix Environmental Social Governance Report 2021 [Sustainability Accounting Standards Board \(SASB\) Report](#). Pg. 15-16.



APPENDIX 8

8. Key Informant Sources

8A. Section 1 – Power and the Motion-Picture Industry: Current State	p. 71
8B. Section 2 – Clean Power Opportunities with Other Sectors	p. 72
8C. Section 3 – Case Studies: Clean Power and Alternative Fuels	p. 73

8A. Section 1 – Power and the Motion-Picture Industry: Current State

Metro Vancouver	Greater Toronto Area	New York	Los Angeles
<ul style="list-style-type: none"> • Metro Vancouver Film Permit Office • Producer, Clarity Films • City of Vancouver Film Permit Office • Sustainability representative for MBSE Canada • International Alliance of Theatrical Stage Employees (IATSE 891) Member, Generator Operator • Creative BC representative • Film Liaison representative from Location Fixer • Sustainability representative for William F. Whites • Portable Electric • Valid Manufacturing • Green Spark Group Professional Experience 	<ul style="list-style-type: none"> • Sustainability representative for William F. Whites • Producer, Quadrant Motion Pictures • Locally-based Line Producer • Sustainability representative for MBSE Canada • Producer, Clarity Films • City of Toronto Film Office representative • Green Spark Group Professional Experience 	<ul style="list-style-type: none"> • Glendale Studios representative • Broadway Studios representative • Shattered Prism (battery power supplier) representatives • New York City Mayor's Office of Media and Entertainment representative • New Jersey Motion Picture and Television Commission representative • Green Spark Group Professional Experience 	<ul style="list-style-type: none"> • Sony Pictures sustainability representative • Netflix sustainability representative • Producer, Clarity Films

Interviews	Additional Outreach
<ul style="list-style-type: none"> • Greater Vancouver Food Truck Festival • Vancouver Farmers Markets • City of Vancouver Film Office • Portable Electric • Destination Vancouver • Vancouver Farmers Markets • Hollyburn Properties Ltd - Landscaping Division (Vancouver) • Vancouver Regional Construction Association • Vancouver Buildings and Civil - PCL • Ventana Construction 	<ul style="list-style-type: none"> • Vancouver Food Trucks • Street Food Vancouver • City of Vancouver - Green Events • International Live Events Association • Fraser Valley Event Planning Association • PCMA Canada West • Vancouver Board of Parks and Recreation • BC Landscape and Nursery Association • British Columbia Society of Landscape Architects (BCSLA) • Great Canadian Landscaping Company • Seymour Lawn Maintenance • Crocus Landscaping • Vancouver Economic Commission • Graham Construction • Sea to Sky Removal • All Roads Construction

8A. Section 1 – Power and the Motion-Picture Industry: Current State

Metro Vancouver	Greater Toronto Area	New York	Los Angeles
<ul style="list-style-type: none"> • Metro Vancouver Film Permit Office • Producer, Clarity Films • City of Vancouver Film Permit Office • Sustainability representative for MBSE Canada • IATSE891 Member, Generator Operator • Creative BC representative • Film Liaison representative from Location Fixer • Sustainability representative for William F. Whites • Portable Electric • Valid Manufacturing • Green Spark Group Professional Experience 	<ul style="list-style-type: none"> • Sustainability representative for William F. Whites • Producer, Quadrant Motion Pictures • Locally-based Line Producer • Sustainability representative for MBSE Canada • Producer, Clarity Films • City of Toronto Film Office representative • Green Spark Group Professional Experience 	<ul style="list-style-type: none"> • Glendale Studios representative • Broadway Studios representative • Shattered Prism (battery power supplier) representatives • New York City Mayor's Office of Media and Entertainment representative • New Jersey Motion Picture and Television Commission representative • Green Spark Group Professional Experience 	<ul style="list-style-type: none"> • Sony Pictures sustainability representative • Netflix sustainability representative • Producer, Clarity Films

8B. Section 2 – Clean Power Opportunities with Other Sectors

Interviews	Additional Outreach
<ul style="list-style-type: none"> • Greater Vancouver Food Truck Festival • Vancouver Farmers Markets • City of Vancouver Film Office • Portable Electric • Destination Vancouver • Vancouver Farmers Markets • Hollyburn Properties Ltd - Landscaping Division (Vancouver) • Vancouver Regional Construction Association • Vancouver Buildings and Civil - PCL • Ventana Construction 	<ul style="list-style-type: none"> • Vancouver Food Trucks • Street Food Vancouver • City of Vancouver - Green Events • International Live Events Association • Fraser Valley Event Planning Association • PCMA Canada West • Vancouver Board of Parks and Recreation • BC Landscape and Nursery Association • British Columbia Society of Landscape Architects (BCSLA) • Great Canadian Landscaping Company • Seymour Lawn Maintenance • Crocus Landscaping • Vancouver Economic Commission • Graham Construction • Sea to Sky Removal • All Roads Construction

8C. Section 3 – Case Studies: Clean Power and Alternative Fuels

Key Informant Interviews	Additional Research and Outreach
<ul style="list-style-type: none"> • Netflix, Sustainability Representative • Location Fixer, Vancouver • BBC UK - Winterwatch/Springwatch Production Team • Film London/British Film Institute • City of Vancouver, Film Permit Office • Shattered Prism, New York • Portable Electric 	<ul style="list-style-type: none"> • GreenBiz website • albert website • Green Production Guide website • Walt Disney Corporate Social Responsibility Report 2021 • Netflix Environment Social Governance Report 2021 • Sustainable Production Forum 2021 Panel Discussions • Green Hydrogen Guidebook from the Green Hydrogen Coalition • BBC website • Reel Green website • Portable Electric website • Shattered Prism website