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VIA EMAIL
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August 14, 2012

FORTISBC INC ADVANCED METERING INFRASTRUCTURE CPCN
EXHIBIT A2-2

Mr. Dennis Swanson
Director, Regulatory Affairs
Regulatory Affairs Department
FortisBC Inc.
Suite 100, 1975 Springfield Road
Kelowna, BC V17 7V7

Dear Mr. Swanson:

Re: FortisBC Inc.
Application for a Certificate of Public Convenience and Necessity
for the Advanced Metering Infrastructure Project

Commission staff submits the following document for the record in this proceeding:

The Marihuana Indoor Production Calculator: A Tool for Estimating Domestic and Export Production Levels and Values.

Yours truly,

Erica Hamilton

/elm
Enclosure
cc: Registered Interveners

The Journal of Criminal Justice Research

RESEARCH ARTICLE

THE MARIHUANA INDOOR PRODUCTION CALCULATOR: A TOOL FOR ESTIMATING DOMESTIC AND EXPORT PRODUCTION LEVELS AND VALUES

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ABSTRACT

The clandestine nature of illicit indoor marihuana production makes is difficult to measure the true extent of marihuana cultivation in a given policing jurisdiction. As a result, law enforcement must rely on estimations in order to understand the scale of the problem in terms of the number of growing operations, the number of growers, or the monetary value of the industry. This article describes an online estimation tool that was

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developed to aid law enforcement in the estimation of the annual production, domestic sale, exportation, and total value of marihuana produced in commercial growing operations within a given jurisdiction.

Keywords: Marihuana, Drug Production, Drug Exportation, Illegal Drug Markets, Law Enforcement, Domestic Consumption

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Brian Carlisle studies at the University of the Fraser Valley in the School of Criminology and Criminal Justice. He has more than 10 years experience working in the legal field; as a Bailiff, Paralegal, Legal Assistant, Advocate, and holds multiple certifications.

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Suzanne Landry is founder of Data Accent Solutions Inc, a data solution company that provides services to a wide range of small businesses, from fire services, to school districts, to other consulting companies sprinkled across Canada and the US. Suzanne has over 20 years of experience in both technical and analytical areas. She has developed a substantial number database applications and solutions on the Windows and Mac platforms, using a wide range of tools, from .NET, SQL Server, MS Access, to

FileMaker Pro. Her focus is on providing users a mechanism to turn data into information, and information into knowledge.

INTRODUCTION

Given marihuana is the most widely used illicit drug worldwide, with between 143 and 190 million users, it should not be surprising that combating production of the drug is a major priority for many jurisdictions (United Nations, 2009). However, due to the clandestine nature of illicit marihuana production, it is difficult for policy makers and law enforcement to measure the true extent of marihuana cultivation within their jurisdictions. This is especially true for marihuana growing operations, or 'grow ops', that are located indoors. As a result, those jurisdictions that face high levels of illicit marihuana production must rely on estimations in order to begin to understand the scale of the problem in terms of the number of operations, the number of growers, or the monetary value of the industry. Since it is highly unlikely that an understanding of the commercial marihuana production industry will move beyond estimates in the near future, we have devised an online tool, the Marihuana Indoor Production Calculator, to aid in the estimation process. Throughout this article we highlight the usefulness of the Marihuana Indoor Production Calculator, inputting the best known data available for British Columbia, Canada to demonstrate its potential for estimating various components of the indoor marihuana cultivation industry in any given jurisdiction.

The focus of the Marihuana Indoor Production Calculator is on those operations that contribute to the illicit marihuana industry. We refer to these operations as commercially viable marihuana growing operations to distinguish them from small operations that may be intended only for personal use. Furthermore, although we recognize that outdoor marihuana cultivation presents a serious problem for some jurisdictions and contributes to the enormous marihuana industry worldwide, the estimates of the Marihuana Indoor Production Calculator are intended specifically for indoor cultivation. Therefore, the estimates provided throughout this article represent those associated to commercially viable marihuana grow ops located within private or commercial buildings through the use of high powered lamps and other equipment. Although the estimates provided in this article are based on available data with regard to marihuana production in British Columbia and represent the best approximations available in that Canadian province, we emphasize that in order to produce the most accurate estimates, the most reliable and current data on the marihuana product in a given jurisdiction should be used. More attention to this point will be provided throughout the article.

IDENTIFYING COMMERCIALLY VIABLE MARIHUANA GROWING OPERATIONS

Marihuana production can be a lucrative illegal endeavor, but not all cases of marihuana cultivation are intended to turn a profit. Smaller operations intended for personal use are illegal and are still a concern, but those operations that are intended for large profits

present greater risks and are a main source for the illicit drug trade. Since the purpose of the Marihuana Indoor Production Calculator is to estimate the size of the commercially viable marihuana production industry, it is important to have the ability to distinguish between those marihuana growing operations that are for personal use and those that are designed specifically to be commercially viable.

The concept of commercial viability in the marihuana production business is likely something that has changed over time. As innovative detection techniques are developed and used by law enforcement, a grower's need for security and counter-detection strategies increase. What was required for a profitable marihuana growing operation in the late 1990s or early 2000s has no doubt changed somewhat from what is currently necessary to compete in the illegal market. This changing reality increases the costs of doing business and thus may force some growers out of the market, leaving marihuana production an industry predominated by high quantity producers who are very sophisticated and extremely competitive.

However, the marihuana growing operations that are intended for personal use may not differ from those that have existed historically. Since grow ops for personal use are separated from the larger illegal production and distribution industry and the chance of detection is generally much lower for small size operations (Bouchard, 2007), it is likely that the factors that may be forcing small and mid-sized commercial operations out of business would have little to no affect. If this is an accurate representation of current progression in the illegal marihuana production industry, it should become increasingly easier to distinguish between those operations that are commercially viable and those that are mainly for personal use.

Recent information that is consistent with what we have come to understand about the nature of indoor marihuana production suggested that the production potential of a growing operation is more a function of the number of lights than the number of plants (Bouchard, 2008). Therefore, the criteria used to determine commercial viability reflects this concept, defining commercial operations based on the number of lights used and the sophistication of the operation, rather than on how many plants were discovered onsite. In setting a standard for commercial viability we considered two main factors: (1) how large an operation is too large for personal use, and (2) how large an operation is needed to make profit?

The first factor was considered more heavily than the second, since the profitability of an operation can depend on a number of features related to both the grower and the market. Therefore, we wanted to set a standard based more on a measure of the potential of the operation itself. If an operation has the potential to produce much more than is needed for personal use, there is a high likelihood that the operator is intending to contribute to the black market, whether or not that the endeavor proves fruitful. Furthermore, previously conducted analyses demonstrated that marihuana growing operations of any number of lights can be profitable over time, especially when the operation involves stealing electricity or generating it onsite. However, we recognize that the risks associated to growing marihuana, the extent of a grower's black market

connections, and the potential for added expenses are all considerations necessary to assess whether an operation of a specific size is indeed commercially viable. Conversely, it must also be emphasized that the value of the profits made from illegal activities is considerably higher since it is accumulated tax free. Based on our understanding of the marihuana necessary for high levels of consumption, the potential yield of growing operations, and the various aspects of the commercial marihuana market, we have tentatively set the definition of commercial viability for the purposes of this article as an operation that uses five or more 1000 W lights. Inherent in this definition is the belief that indoor commercial marihuana grow ops can produce a marketable crop at least four times over a year. Despite the uncertainty with regard a definitive answer on what represents a commercially viable grow op, what can be concluded is that even for very large operations, the setup costs are such that it is highly unlikely that such an operation would ever be intended for only a single crop.

ESTIMATING THE POTENTIAL YIELD OF A MARIHUANA GROWING OPERATION

In order to obtain an estimate of amount of marihuana produced within any jurisdiction, it is important to have an understanding of the yields of marihuana growing operations. Knowing the yield of growing operations allows for estimations of the size of the marihuana industry based on the number of active growing operations rather than relying on data associated to seizures of harvested product. However, estimating the potential yield of a marihuana growing operation has historically been very speculative. Previously, estimates of the annual yield of marihuana growing operations have been predominantly based on the number of plants discovered at the growing site and the number of crops that can be produced in a year. As Bouchard (2008) noted, previous estimates tended to be largely exaggerated because the assumptions about the amount of marketable product per plant were inaccurate. Generally, the per plant yields used by researchers, law enforcement, and policy makers have been large overestimates, sometimes ranging as high as 1 lb or even 1 kg per plant (Bouchard, 2008). We have determined that even the 100 grams per plant estimate originally used by Plecas, Dandurand, Chin, & Segger, (2002) has now been determined to be an over-estimate.

Although the estimates for the amount of marketable product per plant have historically been overstated, researchers trying to understand illegal marihuana production have generally had a strong understanding of the number of crops that can be produced each year. In his estimates, Easton (2004) used the figure of four crops annually for a 100 plant operation. This reflects the figure used by Bouchard (2008), who suggested that large operations (more than 100 plants) would generally produce four crops, while medium and small operation (20 to 100 plants and 1 to 20 plants respectively) would produce three crops. Outdoor operations of any size were estimated to produce only one crop (Bouchard, 2008). For the purpose of the Marihuana Indoor Production Calculator, we contend that a commercially viable indoor marihuana growing operation will produce four crops annually. However, we suggest that if marihuana growing trends in another jurisdiction commonly produce crops at an alternate rate, that difference should be considered when assessing the estimates provided by the calculator.

Recent research from Toonen, Ribot, and Thissen (2006) reported that the yield per plant was 33.7 grams and that generally 15 plants were grown around a single lamp. These findings reflect the general consensus of growers and other researchers (Bouchard, 2008), and would present a better alternative to other grams per plant estimates. However, as much of the yield depends on the amount of light received by each plant, the yield of 33.7 grams per plant may only be accurate for those grow ops that are configured in a similar way with 15 plants around each lamp. Also, as even the best growers experience plant attrition at some time prior to harvesting the crop (Bouchard, 2008), estimating yield purely based on the number of plants present at a growing site may provide an estimate that is over or under the actual yield. As this is the case, an easier and potentially more accurate way to estimate the yield of a marihuana growing operation is to base the estimate on the number of lights rather than plants.

A grower's 'rule of thumb' that was reported by Bouchard (2008), which also reflects our current understanding of marihuana productivity, states that the predictable yield for a marihuana growing operation can be approximated at 1 lb per active light each crop. As 1 lb is the equivalent of 454.5 grams, this easy 'rule of thumb' provides a conservative estimate that generally reflects the yield data from the studies of both Toonen et al., (2006) and Bouchard (2008). For purpose of the Marihuana Indoor Production Calculator, the estimated potential yield of a marihuana growing operation will rely on the assumption that a light produces 454.5 grams each crop. We suggest that unless indoor growing trends differ greatly in the intended jurisdiction, such as generally using lights of much lower wattage, the 1 lb per light estimate would provide the best available standard. Furthermore, a change of thinking about the growing potential of growing operations from one that relies on plants to one that accounts for lights should be adopted by criminal justice policy makers, law enforcement officers, crown prosecutors, and judges when dealing with cases of indoor marihuana production.

THE PREVALENCE OF MARIHUANA GROWING OPERATIONS

Equally as important as having a suitable method to approximate the yield of marihuana growing operations is having an understanding of the number of active growing operations in the jurisdiction. Unfortunately, due to the problems associated to identifying active indoor grow ops, obtaining an accurate number to represent the prevalence of marihuana growing operations is difficult. Currently, in British Columbia, as in other jurisdictions, the number of marihuana growing operations cannot be known with any great certainty. Therefore, some method to estimate the number of growing operations is required for the purpose of the Marihuana Indoor Production Calculator.

Generally, the extent of marihuana production in a jurisdiction must be estimated based on the information from available sources. Police information on the number of marihuana growing operations attended and dismantled is the most common source from which to base estimations of the true number of operation in the province. However, in recent years, some communities in British Columbia have implemented

non-traditional enforcement responses, namely Electrical and Fire Safety Inspection Initiatives (EFSI), to actively deal with some cases of suspected marihuana growing operations (Garis, 2008; Girn, 2007). Information from these EFSI teams or other non-traditional enforcement measures presents an additional source for estimations of the number of active growing operations.

Police data have been used to estimate the larger population of growing operations in some jurisdictions. Using the data from Plecas et al., (2002) on the number of marihuana growing operations discovered by police in British Columbia in 2000, Easton (2004) used an economic model to estimate the number of active grow ops in that year. His estimation of approximately 17,500 was largely based on factors associated to the risk of apprehension and the assumed profitability of a 100 plant operation. However, the foundation of the estimate was the number of founded police investigations during the year. Also, Bouchard (2007) proposed a method of estimating the actual size of the marihuana cultivation industry called a capture-recapture model. He estimated the annual number of marihuana growing operations in the province of Quebec using arrest data and information on the average number of growers involved in an operation of a particular size. From his method, Bouchard (2007) claimed Quebec had approximately 13,000 growing operations for the years 2000 and 2001.

As models for estimating the number marihuana growing operations within a jurisdiction are rare in the research literature, determining a suitable figure to use in the Marihuana Indoor Production Calculator may require an 'educated guess' from an expert who has worked closely with the problem in that jurisdiction. Using police statistics on the number of reported or founded cases of marihuana production in concert with an estimation of the percentage of cases that police discover or solve could be the best method available in some jurisdictions. Perhaps other sources, such as electricity providers, may be able to provide another estimate with which to work. Regardless of the most appropriate method to determine the number of active commercially viable marihuana growing operations in the jurisdiction, it is apparent that this is an area where continuing research is necessary. Just as the nature and sophistication of marihuana production is likely changing (Plecas, Malm, & Kinney, 2005), so too is it likely that that these changes influence the number of active operations as well as their size and location. New research is needed to ensure that the information available to law enforcement and policy makers accurately reflects the practices used by the criminals and criminal organizations that are illegally producing marihuana.

For the purpose of demonstrating the Marihuana Indoor Production Calculator, we propose an estimate of 10,000 commercially viable marihuana growing operations were active in British Columbia around the year 2003. This estimate is based on information provided by BC Hydro (presentation to EFSI/PSIT Regional Meeting, District of Mission, B.C., Sept, 2009) that the approximately 16,000 residential accounts were using electricity at a rate of more than the 93 KWh per day, the threshold for inspection define by the British Columbia's Electrical Safety Regulation (Safety Standards Act, 2004). Not all cases of high consumption are the result of an illegal marihuana growing operation, but a conservative estimate puts the proportion at 50% (discussion at

EFSI/PSIT Regional Meeting, District of Mission, B.C., Sept, 2009). Furthermore, based on findings from Plecas et al. (2005) that on average 20% of marihuana growing operations exhibited signs of electricity theft, this implies an additional 2,000 operations were stealing electricity. With 8,000 residential operations identified through over-consumption and another 2,000 assumed to be stealing, we estimate that 10,000 commercially viable growing operations[2] were active in British Columbia in 2003. This estimate is below the 17,500 proposed by Easton (2004) for the year 2000. With growing sophistication and a likelihood that more operations are stealing electricity or providing power onsite, the current number of commercially viable marihuana growing operations may be much greater than the 10,000 suggested in the current manuscript. However, we are confident in concluding that for the period between 2000 and the present, the number of active commercially viable marihuana growing operations in any one year was not below 10,000.

THE TOTAL ANNUAL PRODUCTION CAPACITY OF COMMERCIALLY VIABLE MARIHUANA GROWING OPERATIONS

Estimating the entire marihuana production in a jurisdiction requires both of the yield of the average marihuana growing operation and a figure to represent the total number of active operations contributing to the market knowledge of size of operations. To this point, we have inputted that there were approximately 10,000 active commercial marihuana growing operations in British Columbia in 2003. The Marihuana Indoor Production Calculator is designed to calculate the annual production capacity of the commercially viable grow ops in a jurisdiction by determining the product of (1) the number of active growing operations, (2) the size of the average grow op (in lights), (3) the yield per light, and (4) the number of crops. Therefore, the next figure required for the calculator is the average size of growing operations in the jurisdiction, measured in the number of active lights used to grow.

As most law enforcement agencies have been more concerned with the number of plants than the number of lights and equipment used to grow, it may be difficult to acquire an accurate figure to represent the average size of growing operations in a specific jurisdiction. Fortunately, Plecas et al., (2005) collected information on the size and sophistication of grow ops in British Columbia during their research. Based on data from marihuana growing operations in 2003, the average size of an indoor operation in British Columbia was 15.5 lights. Given a yield of 1lb per light for each crop and a total of four crops in the year, the average growing operations produced 62 lbs (28.18 kg) over the year. With a population of 10,000 active commercial grow ops within the province, we can conclude that a total of 620,000 lbs of commercial marihuana was

[2] As the 93 KWh threshold for over-consumption does not capture those operations with fewer than 5 – 6 lights (assuming 14 KWh per day for each light), and the average case of electricity theft involved 28 lights, this estimate conservatively reflects the number of commercially viable growing operations and is unlikely to include those small growing operations intended for personal use.

produced during the year. Again, it is important to have ongoing research and statistics on marihuana growing operations to track the changes that may be occurring within this illegal industry, as the size of operations greatly influences their overall annual production.

DOMESTIC CONSUMPTION AND EXPORTATION OF COMMERCIALLY PRODUCED MARIHUANA

The Marihuana Indoor Production Calculator also provides an estimate of the amount of commercially harvested marihuana that is consumed within the jurisdiction, assuming that the excess is transported to other jurisdictions. It may also be the case in some jurisdictions that the amount of commercial marihuana produced does not meet the domestic consumption, and therefore the deficit is likely imported from other jurisdictions. To calculate the domestic consumption, the Marihuana Indoor Production Calculator requires a figure to represent the number of people within the jurisdiction that have used marihuana over the last year. For British Columbia in the year 2004, about 16.8% of British Columbians aged 15 and older had used marihuana in 2004 (Stockwell, Sturge, Jones, Fischer, & Carter, 2006). Given that BC Stats (2009) reports that there were 3,455,602 British Columbians aged 15 and over in 2004, the calculator provides a figure of 580,541 marihuana users in the province during that year. Currently, the Marihuana Indoor Production Calculator relies on data that suggested the average marihuana user smokes 281 joints per year (Gfroerer, Gustin, Virag, Folsom, & Rachal, 1991). With an average weight of 0.515 grams per joint, British Columbia's domestic consumption in 2004 was approximately 84,040 kg (184,888 lbs).[3] Users of the Marihuana Indoor Production Calculator should be aware that the calculations will not properly measure domestic consumption if the average figures of 281 joints per year or 0.515 grams per joint do not accurately reflect the trends in marihuana consumption within the jurisdiction of interest.

In the case of British Columbia, the annual production in around 2003 and 2004 was in the range of 620,000 lbs, while the domestic consumption was 184,888 lbs. The calculator assumes that the remaining commercially produced marihuana is exported to other provinces and the United States. For British Columbia, the domestic consumption represents only about 30% of the total commercial product, leaving 70% to be exported elsewhere. As the estimates of commercially produced marihuana do not take into account those operations intended for personal use, it is probable that the domestic consumption of commercially produced marihuana is even less than the estimate provided here. This should be considered in both jurisdiction that produce more than the domestic consumption and those that produce less.

[3] As 16.8% of 3,455,602 provides a figure of 580,541.136 annual marijuana smokers, the estimated domestic consumption presented here is slightly higher than the 84,013 kg (184,829 lbs) that would be calculated if the 580,541 figure was used.

THE VALUE OF COMMERCIALLY PRODUCED MARIHUANA

To measure the size of the marihuana production industry in a given jurisdiction, it is important to not only know the quantity that is produced, but also to be able to gauge the economic value of the industry. As the value of bulk marihuana varies by jurisdiction, in order to calculate this figure, the Marihuana Indoor Production Calculator requires the user to indicate the per pound price of marihuana sold domestically as well as the value of domestically produced marihuana sold in other jurisdictions. For the purpose of the calculator, the export value should represent a conservative estimate of the price at which marihuana is sold in the jurisdiction which is believed to import the majority of the domestically produce marihuana.

From our understanding of the marihuana industry in British Columbia and information from police sources, we estimate that marihuana produced in the province sells domestically for around $2000 CAD/lb. Therefore, the revenue generated by growers in British Columbia is approximately $1.24 billion. However, we also know that the price of British Columbia's marihuana varies greatly depending on where it is sold. Given that 70% of the marihuana produced in British Columbia is exported, those who traffic the illegal product are also generating revenue by selling for a higher price in other jurisdictions. The Office of National Drug Control Policy (2003) reported that in the early years of this decade, 'BC bud' could be sold in some American metropolitan areas for as high as $5000 – $8000 USD per pound. For the purpose of this article, we assume that all of the 70% of British Columbia's commercially produced marihuana that left the province was sold in the United States for at least $3000 CAD[4]. Given these figures, the Marihuana Indoor Production Calculator indicates that British Columbia's marihuana exporters generated approximately $1.3 billion. Adding the wholesale revenue from exported marihuana with the 30% sold domestically for $2000 per pound, the total value of the entire wholesale market for British Columbia's marihuana is $1.67 billion.

SUMMARY

Marihuana production is a lucrative illegal endeavor that poses many problems for communities and fuels the activities of organized criminals. The problems associated with commercially viable grow ops extend beyond British Columbia to many other jurisdictions. There is a need for tools to help us to better understand the nature and extent of marihuana production around the world, specifically in jurisdictions where production primarily takes place indoors within residential areas in communities. The Marihuana Indoor Production Calculator presents one such tool that can be used to provide estimates of the size of the problem.

[4] To be conservative we estimated that a pound of marijuana could be sold for the equivalent of $3000 CAD in the United States. This number is consistent with source within the Royal Canadian Mounted Police.

The figures presented in this article were used to demonstrate how the Marihuana Indoor Production Calculator can provide an indication of the size of the marihuana production industry within any jurisdiction. The data provided for British Columbia can be interchanged with information from other jurisdictions to provide a measure of the quantity of marihuana produced, the amount that is consumed domestically and exported, and the total value of the illegal industry. It is important to ensure that the data used in the calculator are as current as possible and generally represent the trends within the jurisdiction. As is apparent from the discussion of British Columbia's marihuana production industry, continued research is necessary to improve our understanding of this illegal industry in order to help the efforts of law enforcement and criminal justice policy makers.

To access the Marihuana Indoor Production Calculator, follow this link:
http://www.ufv.ca/crimcalc/mgocalculator.aspx

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