

NO: R056

COUNCIL DATE: APRIL 14, 2014

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## REGULAR COUNCIL

TO: **Mayor & Council** DATE: **April 14, 2014**

FROM: **General Manager, Planning and Development** FILE: **0540-20 AFSAC**  
**General Manager, Engineering**

SUBJECT: **Proposed Amendments to Surrey Zoning By-law, 1993, No. 12000 for the Purpose of permitting Cogeneration Facilities at Greenhouses in the A-1 and A-2 in Agricultural Zones**

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## RECOMMENDATION

The Planning and Development Department and the Engineering Department recommend that Council:

1. Receive this report as information;
2. Approve amendments to Surrey Zoning By-law, 1993, No. 12000, as documented in Appendix 1 of this report which, if adopted, will act to permit and regulate cogeneration facilities as an accessory use to a greenhouse in each of the "General Agriculture Zone (A-1)" and the "Intensive Agriculture Zone (A-2)," respectively;
3. Authorize the City Clerk to bring forward the necessary amendment by-law for the required readings and to set a date for the related public hearing; and
4. Instruct the City Clerk to forward a copy of this report and the related Council resolution to the BC Greenhouse Growers Association.

## INTENT

The purpose of this report is to obtain Council approval for amendments to Surrey Zoning By-law, 1993, No. 12000 (the "Zoning By-law") to permit and regulate combined heat and power cogeneration facilities that are accessory to a greenhouse operation, in the "General Agriculture Zone (A-1)" and "Intensive Agriculture Zone (A-2)", as documented in Appendix 1 of this report.

## BACKGROUND

In May 2013, the BC Ministry of Agriculture adopted bylaw standards that provide a set of criteria for use by local governments to regulate combined heat and power generation (cogeneration) facilities at greenhouses in the Agricultural Land Reserve ("ALR"). Attached as Appendix 2 to this report is the accompanying Discussion Paper and Standards titled "Regulating Combined Heat and Power Generation at Greenhouses in the ALR", which focuses on permitting and land use

issues to reduce barriers to cogeneration approvals. Part 4 of this document contains the definitions and bylaw criteria established as the Ministry's Bylaw Standard.

On September 12, 2013 the Agriculture & Food Safety Advisory Committee ("AFSAC") reviewed the Bylaw Standards and expressed support for the concept of cogeneration as an accessory use to a greenhouse operation. The AFSAC did have some concerns about these facilities becoming standalone operations, or the possibility of a facility not being directly linked to the ownership of a farm operation. The AFSAC suggested adding a requirement that if a greenhouse ceased to operate then the accessory cogeneration facility would also cease to operate. Following its review, the Committee recommended that,

*"Combined Heat and Power Generation at Greenhouse (Cogeneration), be moved to a higher priority level on the AFSAC work program in order to identify concerns and have some analysis around those concerns".*

At its Regular meeting on November 25, 2013, Council heard a delegation from the BC Greenhouse Growers Association regarding the need to allow cogeneration facilities as a permitted use on agricultural land. After considering the delegation, Council directed staff to:

*"Undertake all necessary actions to prepare a report complete with recommendations for consideration by Council regarding the request of the (BC Greenhouse Growers Association) delegation".*

On February 6, 2014 the AFSAC received a presentation on a draft bylaw amendment proposal for cogeneration in agricultural zones based on Ministry Bylaw Standards, and recommended that the General Manager of Planning and Development:

*"Bring forward to Council a Zoning By-law amendment to the A-1 and A-2 Zones to permit and regulate cogeneration facilities as an accessory use to a greenhouse in agricultural areas of the City; but without the need for registration of a 219 Covenant associated with the facility or additional Business License applications as part of approval process, in order to reduce obstacles to greenhouse growers when implementing energy efficient technologies, in accordance with the 2013 Ministry Bylaw Standards for Cogeneration Facilities".*

## **DISCUSSION**

Cogeneration involves using a combined heat and power engine to produce thermal and electrical energy. Combined heat and power engines also release CO<sub>2</sub> that can be captured and used as a fertilizer in greenhouse operations. Cogeneration facilities are appealing to greenhouse operators because of reduced energy costs and the increased availability of CO<sub>2</sub>. Energy is a significant cost driver to produce greenhouse crops and accounts for approximately 25% of the total production costs for greenhouse vegetable crops in BC. Cogeneration is just one option being considered by greenhouse growers to reduce these energy costs, improve energy efficiency, and increase the availability of CO<sub>2</sub> to enhance crop production. The potential benefits are even more significant for larger greenhouse growers. Cogeneration has also been shown to reduce losses of electricity that inevitably occur during transmission from a large central power station, which is estimated to be around 9-10% of net generation, helping make Surrey greenhouse operations more competitive on the regional and national scale.

Combined heat and power engines would not entirely replace natural gas boilers within a greenhouse. A combination of the two systems is necessary to obtain the higher heat provided by boilers at certain times of the year. Combined heat and power engines consume almost twice the natural gas as a standard boiler to produce the same thermal energy and, therefore, additional fuel costs must be offset by the value of the electricity produced to light the greenhouses and the CO<sub>2</sub> produced for greenhouse crop fertilization. It is expected that a typical cogeneration system would produce a net surplus of electricity even when high intensity lighting is utilized by the greenhouse.

Surplus electricity may also be sold to BC Hydro through the Standing Offer Program established by the utility, creating an additional revenue stream for BC greenhouse growers.. Obtaining an Energy Purchase Agreement (EPA) through the Standing Offer Program will allow greenhouse growers to operate a cogeneration project and sell electricity to the utility at a pre-determined price under conditions set by BC Hydro.

Amending the Zoning By-law to permit cogeneration projects in agricultural areas aligns with the City's Economic Diversification Strategy and Agriculture Protection and Enhancement Strategy to support and grow a vibrant agriculture-innovation and clean technology sector. An increase in the number of cogeneration projects within the City would help attract cogeneration technology product and service providers to establish a business presence in Surrey.

There are approximately 44 greenhouses in Surrey, containing over 450,000 square metres of production capacity. The City received a preliminary inquiry for a cogeneration facility in South Surrey in August 2013; however, no formal rezoning application to permit a cogeneration facility in Surrey has been received to date.

### **Zoning By-law Amendment**

Cogeneration facilities are not currently permitted in Surrey's Agricultural zones either within or outside of the ALR. The proposed Zoning By-law changes would amend the "General Agriculture Zone (A-1)" and "Intensive Agriculture Zone (A-2)" to allow for the installation and use of natural gas fuelled cogeneration facilities accessory to greenhouses. The regulations were drafted in accordance with a portion of the standards adopted by the Ministry of Agriculture Bylaw Standards (Appendix 2).

The intent of the Zoning By-law amendment is to address the needs of greenhouse growers while protecting the City's agricultural land base from non-farm activity. This entails discouraging cogeneration facilities that far exceed the heating needs of a greenhouse in order to generate revenue through the sale of electrical power. The proposed regulations are also intended to minimize the impact of cogeneration facilities on neighbouring property owners by establishing minimum required setbacks.

### **Summary of Proposed Zoning By-law Amendments**

A summary of the proposed amendments are as follows:

## 1. Definitions

The terms "cogeneration facility", "combined heat and power engine" and "greenhouse" are defined to clarify the type of system that may be permitted, the sizing of systems and the conditions under which they are permitted as accessory uses;

## 2. Permitted Accessory Uses

Cogeneration facilities are proposed to be permitted as an accessory use to an agricultural or horticultural greenhouse operation. This is intended to ensure that cogeneration systems are used primarily to meet required greenhouse demand for heat, electricity and CO<sub>2</sub>. Producing power under the *BC Hydro Standing Order Program* in order to generate an additional revenue stream would be considered an authorized use only in association with an active greenhouse operation;

## 3. Setbacks

Setbacks of 15 metres (49 feet) from the side and rear yard, and a setback of 30 metres (100 feet) from a front yard and a side yard along a flanking street are proposed for a cogeneration facility. If the side yard or rear yard abuts a residential zoned lot, any machinery used for cogeneration must be located at least 24 metres (80 feet) from such a lot line and emit a noise level no greater than 60 dB(A) at the perimeter of the lot. This setback is consistent with existing zoning requirements for other types of generators and machinery in the agricultural zones; and

## 4. Criteria for Cogeneration Facilities

The proposed amendments were drafted to be generally consistent with the standards established in the Ministry of Agriculture's Guidelines, with slight modifications appropriate to Surrey's Zoning By-law standards and definitions.

The proposed criteria include:

- the cogeneration facility must be associated with a greenhouse on the same lot;
- the lot must be classified as a farm operation by the BC Assessment Authority;
- the combined heat and power engine capacity must not exceed 1.0 megawatt of electricity for each hectare of land used for greenhouses, but may be increased to 1.5 megawatts of electricity for each hectare of land used for a greenhouse if high intensity lighting (greater than 10,000 lux) is used in the greenhouse;
- The cogeneration facility will be regulated by:
  - the *Agricultural Land Commission Act*;
  - the *Clean Energy Act*;
  - the *Environmental Management Act*;
  - the *Greater Vancouver Regional District Air Quality Management Bylaw*; and
  - the BC Hydro Standing Offer Program.

These regulations are intended to ensure cogeneration facilities are appropriate for the site and are operated primarily to benefit the greenhouse operation and not primarily as a way to generate revenue from the sale of electrical power. The proposed amendments anticipate the use of natural gas as the fuel for cogeneration facilities; however, alternative fuels may be considered on

a case by case basis by way of a development variance permit (DVP). The DVP approval process may take into account such factors as the required footprint of the fuel storage, increased traffic to deliver the fuel and dust from the fuel storage.

### **Cogeneration Facility Approval Process and Implementation**

Should the proposed Zoning Bylaw amendments be adopted by Council, a greenhouse operator in Surrey installing a cogeneration facility would initiate the following steps:

#### **1. *Provincial Agricultural Land Commission Approval***

Since the land use regulation under the *Agricultural Land Commission Act* does not currently permit cogeneration facilities in the ALR, the ALC will consider this use as a non-farm use application. The ALC has agreed to streamline applications for cogeneration facilities that are based on Ministry Bylaw Standards and where the proposed use demonstrates a clear benefit to an agricultural operation.

It is a requirement of the ALC that non-farm use permit applications be forwarded to the Commission by way of a resolution of City Council. To streamline the application process, Council may consider a resolution to forward a co-generation application to the ALC in conjunction with approving AFSAC recommendations, since non-farm use applications are forwarded to the AFSAC for comment;

#### **2. *Application for Building Permit***

A building permit is required for a cogeneration facility and any supporting structures or buildings to meet BC Building Code requirements. Applicants must provide technical information in support of the building permit application, which will be circulated as part of the normal referral process, (i.e., to Planning and Development Department staff, Surrey Fire Services, etc.). The Building Division may require a copy of the farm's BC Assessment notice to confirm active farm status, and the farm operation's Producer Class 1 License allocation report to determine the appropriate scale of the facility based on the size of the greenhouse operation;

#### **3. *Air Quality Permit from Metro Vancouver***

Under current Metro Vancouver regulations, applicants for cogeneration facilities require an Air Quality Permit issued by Metro Vancouver. A maximum emissions rate for the cogeneration operation must be met in order to obtain a permit; and

#### **4. *BC Hydro Standing Offer Program Application***

In order to sell surplus electricity to BC Hydro under the utility's Standing Offer Program, a greenhouse operator must enter into an Energy Purchase Agreement (EPA) with BC Hydro. BC Hydro will assess the ability of the project to consistently achieve the efficiency rate specified in the Standard Form EPA. BC Hydro may reject an application if it determines the project will not achieve the minimum efficiency rate of 80% on a consistent basis.

## Legal Services Review

Legal Services has reviewed this report and its recommendations and has no concerns.

## SUSTAINABILITY CONSIDERATIONS

The implementation of a Zoning By-law amendment to permit cogeneration facilities in agricultural areas will support the Economic, Socio-Cultural, and Environmental Pillars of the City's Sustainability Charter under the following specific elements of the Charter:

- EC8: Energy Security: by promoting the use of low-impact, renewable energy sources, promoting community energy solutions; and providing opportunities of a district energy system that is potentially fuelled from a sustainable fuel source such as waste;
- EC12.2: Working with the Agricultural Sector: by enhancing the productivity of ALR lands and to encourage increased production of ALR lands;
- EN2: Waste Reduction: by potentially introducing waste to energy conversion opportunities;
- EN10: Integrated Community Energy Master Plans: by developing an Integrated Community Energy Master Plan for the City Centre and by working with private property; and
- SC14.2: Promote buying local farm products: by promoting new methods for efficient food production.

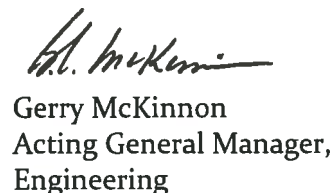
## CONCLUSION

Based on the above discussion, it is recommended that Council:

- Approve amendments to Surrey Zoning By-law, 1993, No. 12000, as documented in Appendix 1 of this report which, if adopted, will act to permit and regulate cogeneration facilities as an accessory use to a greenhouse in each of the "General Agriculture Zone (A-1)" and the "Intensive Agriculture Zone (A-2)," respectively;
- Authorize the City Clerk to bring forward the necessary amendment by-law for the required readings and to set a date for the related public hearing; and
- Instruct the City Clerk to forward a copy of this report and the related Council resolution to the BC Greenhouse Growers Association.



Jean Lamontagne  
General Manager,  
Planning and Development



Gerry McKinnon  
Acting General Manager,  
Engineering

MK/da/saw

### Attachments:

Appendix 1 – Proposed Amendments to Surrey Zoning By-law, 1993, No. 12000

Appendix 2 – Ministry of Agriculture Bylaw Standards for Cogeneration Facilities

**Proposed Amendments to  
Surrey Zoning By-law, 1993 No. 12000, as amended**

The following amendments are proposed to Surrey Zoning By-law, 1993, No. 12000, as amended:

**AMENDMENTS TO PART 1 DEFINITONS**

1. In Part I Definitions add the following definitions in the appropriate alphabetical order:

**"Cogeneration Facility**

means the *Combined Heat and Power Engine* and all additional components needed to achieve the production and transfer of heat and electricity from the engine to the *greenhouse* or interconnection site.

**Combined Heat and Power Engine**

means an engine and all additional components that produces both electricity and thermal energy for heating or cooling from a natural gas fueled input.

**Greenhouse**

means a *building* covered with translucent material and used for the purpose of *horticulture*."

**AMENDMENTS TO PART 10 A-1 ZONE:**

1. **Section B. Permitted Uses**

Section B. is amended by deleting the period and adding "; and" after Sub-Section B.9.(g) followed by:

"(h) *Cogeneration Facility* provided all of the following are satisfied:

- i. the *Cogeneration Facility* shall be associated with a *greenhouse* on the *lot*;
- ii. the *lot* is a *farm operation*;
- iii. the *Combined Heat and Power Engine* capacity must not exceed 1.0 Megawatt of electricity for each hectare of land used for *greenhouses*; and
- iv. despite Sub-Section B.9.(h) iii. the *Combined Heat and Power Engine* capacity may be increased to 1.5 Megawatts of electricity for each hectare of land used for a *greenhouse* if high intensity lighting (greater than 10,000 lux) is used in the *greenhouse*."

2. **Section F. Yards and Setbacks**

Sub-Section F.1(a) **Minimum setbacks** is amended by replacing the second paragraph in the first row under the heading **Setback Use** with:

"*Buildings* for Uses Permitted Under Sections B.1, B.4, B.5, B.9(c) and B.9(h) of this Zone, including *Accessory Buildings* and *Structures*"

3. **Section L. Other Regulations**

Section L. is amended by adding the following after Section 13:

- "14. *Cogeneration Facility* shall be regulated by the *Agricultural Land Commission Act/Regs/Orders*, Clean Energy Act, S.B.C. 2010, c. 22 as amended, the Environmental Management Act, S.B.C. 2003, c. 53 as amended, the "Greater Vancouver Regional District Air Quality Management Bylaw No. 1082, 2008" as amended, and the B.C. Hydro Standing Offer Program as amended."

**AMENDMENTS TO PART 11 A-2 ZONE:**

**1. Section F. Yards and Setbacks**

Sub-Section F.1(a) **Minimum setbacks** is amended by replacing the second paragraph in the first row under the heading **Setback Use** with:

*"Buildings for Uses Permitted Under Sections B.1, B.4, B.5, B.9(c) and B.9(h) of this Zone, including Accessory Buildings and Structures"*

**2. Section L. Other Regulations**

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**Regulating  
COMBINED HEAT AND POWER GENERATION AT GREENHOUSES  
in the ALR**

**DISCUSSION PAPER AND STANDARDS**

**May 2013**

**Prepared by:  
Sustainable Agriculture Management Branch**

## **Executive Summary**

This discussion paper was prepared by the BC Ministry of Agriculture (AGRI) and outlines a set of criteria that can be used by local governments to regulate combined heat and power generation (cogeneration) at greenhouses in the Agricultural Land Reserve (ALR).

The demand for cogeneration at greenhouses is fueled by international climate change policies, increased focus on energy efficiency and the appetite of farmers to integrate new technologies into their businesses that will help them remain competitive in international markets.

This paper focuses on addressing the land use issues of cogeneration at greenhouses in British Columbia. The criteria that are presented reflect analysis by AGRI and Agricultural Land Commission (ALC) staff. The draft discussion paper, dated December 15, 2011 was used to solicit feedback from stakeholders. The feedback and further analysis by AGRI staff has been incorporated into this discussion paper dated April 2013. Part 4 of this document contains the definitions and bylaw criteria established as the Minister's Bylaw Standard under section 916 of the *Local Government Act*.

Parts 1, 2 and 3 provide the basis for developing standards in Part 4 that can be used by local governments to establish land use policy or regulations related to cogeneration at greenhouses. Although the emphasis of the criteria is on natural gas-fired cogeneration in the South Coastal region, local governments that are outside these areas may use the information as they see appropriate. The standards are intended to assist local governments in addressing the demand for cogeneration at greenhouses without compromising the long term productivity of agricultural land.

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## **Introduction**

The draft discussion paper dated December 15, 2011 outlined a set of criteria for regulating the use of combined heat and power (CHP) generation, commonly referred to as cogeneration, at greenhouse operations in the ALR. The paper served as a basis for further discussion with local governments and the greenhouse sector to ensure the criteria effectively deal with the issue of cogeneration from a land use regulation perspective. The criteria were developed to reflect analysis undertaken by AGRI and ALC staff.

The criteria are intended to address the needs of the greenhouse sector while protecting the agricultural land base from non-farm use related activities. The criteria may be modified by local governments to meet local agricultural needs.

Parts 1, 2 and 3 of the initial draft Discussion Paper have been updated to incorporate the feedback from the consultation period and further analysis done by staff to reflect the criteria development process, background on the issue and the policy, guidelines and regulations in place at the time. Part 4 of this document provide the definitions and bylaw criteria established as the Minister's Bylaw Standard.

## Part 1 – Criteria Development Process

The intent of this process is to develop criteria that can be used by local governments to establish land use policy or regulations to address on-farm energy production through natural gas-fired cogeneration systems. Following consultation with stakeholders, these criteria, if approved by the Minister, may become standards and be incorporated into the “Guide for Bylaw Development in Farming Areas”.<sup>1</sup>

### 1.1 Purpose & Goals

The purpose of establishing the criteria is to meet the agriculture industry’s demand for cogeneration in a manner that minimizes the impact on agricultural land and addresses local government concerns. These criteria will:

1. meet the needs of the greenhouse sector;
2. minimize the impact of cogeneration in the agricultural area; and
3. minimize the risk of cogeneration systems being installed for non-farm purposes.

### 1.2 Scope

While there may be other issues associated with energy production through cogeneration, the criteria considered in this paper only address the land use issues of regulating the scale of the cogeneration plant relative to the greenhouse facility and the heat demand of crops grown in the greenhouse. The criteria attempt to meet the needs of greenhouse operators who wish to invest in cogeneration systems, and at the same time, discourage the establishment of cogeneration facilities in the ALR that far exceed the heating needs of the greenhouse. The need for cogeneration is isolated to the South Coastal region where the larger greenhouse operations are located. Therefore, the criteria have been developed for greenhouse operations in the ALR in the South Coastal region.

These criteria have been developed for natural gas-fired cogeneration which minimizes the land use impacts due to the fuel source. If the cogeneration is fueled by other sources such as biomass, then other potential impacts should be considered in the criteria as well. Examples of the other impacts are the footprint of the fuel storage, increased traffic to deliver the fuel and dust from the fuel storage.

The BC Ministry of Agriculture recognizes that other agencies’ regulations and requirements (BC Building Code, BC Environmental Management Act, etc.) must still be met and that the establishment of a cogeneration facility in the ALR must be consistent with the ALC Act and policy.

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<sup>1</sup> Under the *Local Government Act* (Part 26, Division 8, Section 916), the minister responsible for the *Farm Practices Protection (Right to Farm) Act* can develop bylaw standards to guide the development of zoning and farm bylaws. Development of provincial standards is intended to promote consistency in the regulation of, and planning for, farming. However, provision has been made under Section 916 (3) to allow the standards to differ, if necessary, to respond to BC’s diverse farming industry and land base.

## **1.3 Stakeholders**

The following groups will be involved in the criteria development process:

- BC Ministry of Agriculture staff;
- Agricultural Land Commission staff;
- BC Greenhouse Growers' Association;
- United Flower Growers Co-operative Association;
- Local governments and their Agricultural Advisory Committees;
- Cogeneration technology providers;
- BC Ministry of Environment (MoE) staff; and
- BC Ministry of Energy and Mines staff.

## **1.4 Objectives of the Process**

The objectives of the development process are to:

1. create a set of criteria for review by stakeholders;
2. consult with stakeholders; and
3. develop standards that local governments can adopt and apply as policy or regulation.

## **1.5 Methods to Develop the Criteria**

### **Key Steps**

Five key steps will be undertaken to develop the criteria:

1. Review relevant literature including AGRI and ALC policies;
2. Examine how other jurisdictions have addressed the issue of co-generation at greenhouses;
3. Consider case-studies and reports on co-generation at BC greenhouses;
4. Review and compare existing local government regulations and policies; and
5. Consult with AGRI staff, ALC staff, Ministry of Environment staff, local governments and the agriculture industry.

### **Process to Date**

Current policies and regulations regarding on farm energy production in BC were examined and used in developing the criteria. Throughout the research process, careful attention was paid to the varying energy policies and energy markets that were driving adoption in co-generation at greenhouses in other jurisdictions. The pros and cons of co-generation have been considered from an environmental and economical point of view. Finally, the criteria were developed with respect to how co-generation should be regulated in the ALR. This information was then considered by a committee comprised of AGRI and ALC staff who worked together to draft the criteria currently listed in Part 4 of this document.

This discussion paper will be distributed to the MoE, ALC, local governments and the agriculture industry for their review and feedback. Once stakeholder input has been received and incorporated into the discussion document, the criteria will be sent to the Minister of Agriculture for final approval. Once approval has been received, the criteria may be incorporated into the "Guide for Bylaw Development in Farming Areas". Local governments would then be encouraged to amend their zoning bylaws to be consistent with the Minister's Bylaw Standard.

## Part 2 – Background

### 2.1 State of the Greenhouse Sector in BC

The BC greenhouse sector uses modern greenhouses to produce high-valued vegetables and a wide range of ornamental plants, including both flowering potted plants and cut flowers. The sector accounts for almost 40% of farm cash receipts for agricultural crops in BC and is an important contributor to the provincial economy (BC Ministry of Agriculture, 2010). The majority of the production area is located in the Lower Mainland area, although production also occurs on Vancouver Island and in the Okanagan. The sector experienced considerable expansion through the 1990s (Figure 1), but growth stalled early in 2000 due to significant increases in the cost of natural gas and the value of the Canadian dollar. The production area has been stable at roughly 500 hectares for the past 7 years.

Total farm gate sales follow a similar trend to production area and have been relatively flat since 2004 for both vegetable (~\$240 million) and ornamental (~\$300 million) crops (Figure 2). Although sales are flat, net operating income and net worth are down (BC Ministry of Agriculture and Lands, 2009). Declines in revenue experienced in the mid-2000s for vegetable crops have been replaced by modest gains the past 2 or 3 years (Figure 3). Nonetheless, revenues in 2010 were below levels in 2003 by 15% for cucumbers and peppers and by 3% for tomatoes. The declines in revenue are directly related to changes in product prices.

The average price received for all greenhouse vegetable crops was higher in the 4-year period from 2003 to 2006 versus 2007 to 2010. The average price has declined 15% for peppers, 13% for tomatoes-on-vine and 3% for beefsteak tomatoes, and 4% for cucumbers. Data on changes in price and production per area are not available for greenhouse ornamental crops. However, it is clear from Table 1 that the average price of ornamental crops is also declining. The average change in selling price of eleven selected floriculture crops at the local flower auction declined 6.5% in 2008 and 5.7% in 2009 (Table 1).

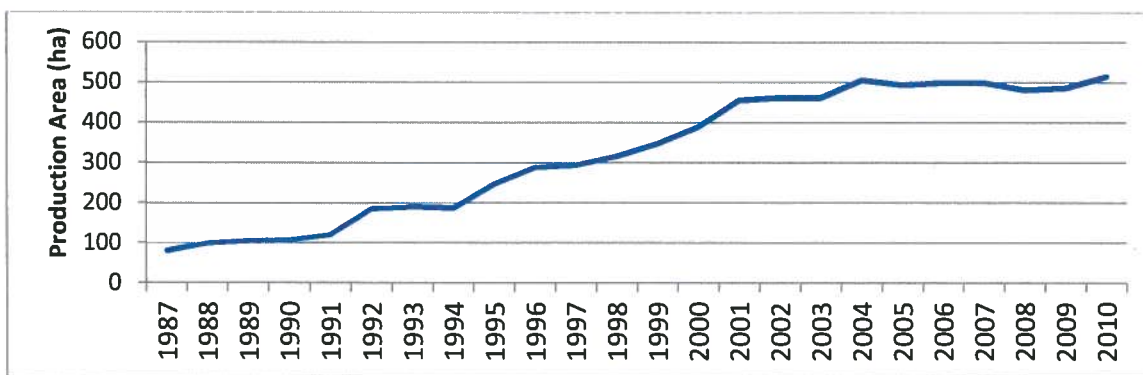


Figure 1 Greenhouse area of production from 1987 to 2010 (Source: Statistics Canada)



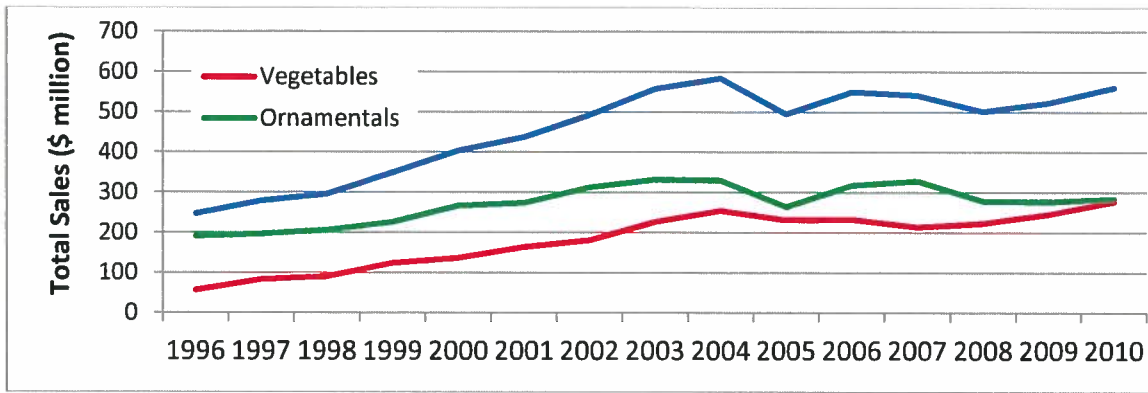


Figure 2 Total sales of greenhouse vegetables and ornamentals from 1996 to 2010 (Source: Statistics Canada)

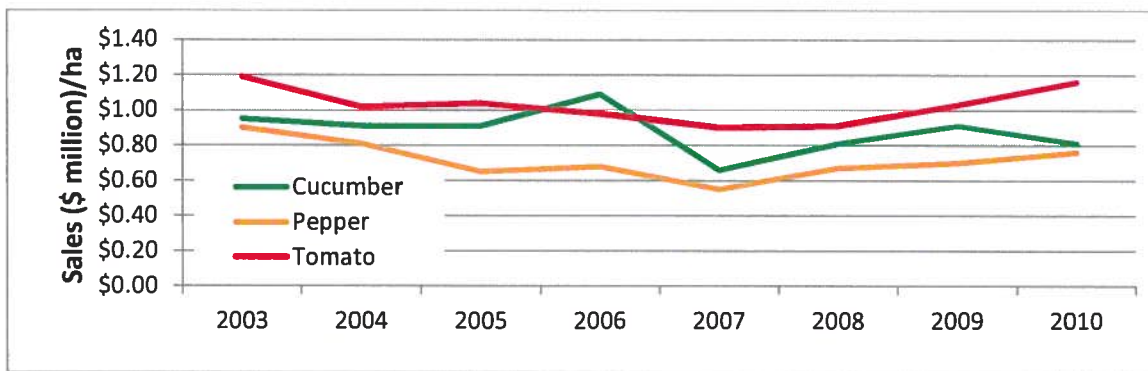


Figure 3 Greenhouse vegetable sales per area of production (Source: BC Vegetable Marketing Commission)

Table 1 The % change in price and units sold for 2008 and 2009 versus the average for the previous 4 years for 11 representative floriculture crops (Source: UFG Product Statistics)

Crop		% Change in Price	
		2008	2009
Cut Flower	Gerbera	-7.8%	+9.3%
	Alstroemeria	-12.0%	-7.9%
	Rose, Std (55 cm)	-9.4%	-5.8%
	Tulips	+0.8%	-13.2%
	Gladiolus (field)	-1.2%	+6.0%
	Cymbidium (on stem)	-14.2%	-27.0%
Potted	Poinsettia (15 cm)	-9.5%	-16.8%
	African violets (10 cm)	0.0%	+8.4%
	Tropical (10 cm)	-8.7%	-3.8%
	Geranium (10 cm)	+1.8%	+15.9%
	Primula (10 cm)	-0.4%	+5.5%
Average Change		-6.5%	-5.7%

Export sales are very important for the greenhouse sectors. For instance, it is estimated that about 60% of BC-produced greenhouse vegetables are exported. The majority of exports go to the U.S. market. Greenhouse growers in BC are facing increasing competition in the domestic

and export markets. For the greenhouse vegetable sector, this has materialized due to recent expansion of protected cultivation in Mexico. The area of protected cultivation in Mexico has increased nearly 40% in the past three years to approximately 15,000 hectares in 2010 (USDA Foreign Agricultural Service, 2010). In addition, some Mexican operations are now producing year-round which is reducing the price premium that BC growers previously received in April to June. There is also increasing competition in the ornamental sector from US product and cut flowers grown in South America.

Canadian greenhouse growers are becoming less competitive as a result of the appreciation of the Canadian dollar and increases in the cost of inputs, such as fertilizers, pesticides, labour, and fuel. The Canadian dollar has appreciated 32% relative to the US dollar since March 2009, and in the past year the price of fertilizer has increased 8% for nitrogen (urea), 32% for phosphate, and 9% for potassium (Shiell, 2011). The industry also contends that the BC Carbon Tax is eroding the competitiveness of the industry.

Energy is a significant cost to produce greenhouse crops and accounts for approximately 25% of the total production costs for greenhouse vegetable crops in BC (Willis Energy Services, 2005). For this reason, the greenhouse sector has been quick to adopt energy saving technologies such as thermal screens, heat storage, and more efficient boilers. Many growers have also switched to biomass as a fuel source. However, growers continue to see their margins decline and are looking for new options to reduce their costs of production and improve their industry competitiveness.

## **2.2 Cogeneration at BC Greenhouses**

Cogeneration is one option being considered by BC greenhouse growers to reduce energy costs and to increase the availability of CO<sub>2</sub> to enhance crop production. In 2005, Willis Energy Services studied the economics of cogeneration for the BC greenhouse industry. The authors of the report stated that cogeneration is well-suited for the industry because: greenhouses require heat at a relatively low temperature, many greenhouses are located close to load centers, and greenhouses can use the CO<sub>2</sub> produced (Willis Energy Services, 2005). BC greenhouse growers have seen their competitors successfully implement cogeneration at facilities around the world and now wonder if they can take advantage of similar technology adoption here in BC. For example, a successful cogeneration installation in the Netherlands saw Royal Pride Holland achieve 20% reduced production costs on a 45 ha greenhouse tomato operation (Neville, 2009).

Cogeneration is most attractive to the larger greenhouse operations in the Lower Mainland because they have the resources and scale of production to justify the investment in this technology. Greenhouse vegetable operations are more apt to consider cogeneration than floriculture operations due to the higher heat demand and benefits of CO<sub>2</sub> fertilization for vegetable crops. Research has shown that increasing the CO<sub>2</sub> level by 400 ppm can increase pepper fruit set by 55% and production by 30% (BC Ministry of Agriculture, Fisheries and Food, 1996).

British Columbia's energy policy and pricing has hindered the uptake of cogeneration in BC compared to other jurisdictions around the world. However, the recent announcement of BC Hydro's Standing Offer Program (SOP) has once again triggered BC greenhouse growers to explore the opportunity of implementing cogeneration facilities at their operations. If greenhouse growers can negotiate favorable, long term electricity and natural gas contracts with utility companies in BC, on-farm cogeneration could make greenhouse operations more competitive in their industry.

Other benefits of cogeneration include producing electricity in communities where it is needed, thereby avoiding or deferring investments in transmission and distribution network infrastructure (Kerr, 2008; PEW Center, 2011), and displacing higher-cost generation plants (Kerr, 2008). Cogeneration also reduces losses of electricity that inevitably occur during transmission from a large central power station, which are estimated to be around 9-10% of net generation (Kerr, 2008; Willis Energy Services, 2005).

The barriers to adopting cogeneration at greenhouse in BC are mostly economic and require careful negotiation between BC Hydro, Fortis BC and the BC Greenhouse Growers Association. The key issues identified by the industry are:

- The acceptance of natural gas fueled electricity for BC Hydro's SOP;
- Natural gas supply constraints and commodity price risks;
- Capital and Interconnections Costs;
- Agricultural vs. Industrial Zoning for CHP units; and
- Securing permits and paying fees prior to SOP application.

### **2.2.1 BC Hydro Standing Offer Program**

BC Hydro implemented a SOP to encourage the development of small and clean or renewable energy projects throughout British Columbia. The program was developed to streamline the process for small developers selling electricity to BC Hydro, simplify the contract and decrease transaction costs for developers while remaining cost-effective for rate payers. The SOP embodies the principles and policies set out in the [BC Energy Plan](#) and the [Clean Energy Act](#) (BC Hydro, 2011a).

Current SOP pricing applies to projects between 0.05 MW and 15 MW. A base price is set according to the regions defined by BC Hydro. Regional pricing varies from \$94.86/MWh in the Peace River region to \$103.69/MWh in the Lower Mainland (2010). BC Hydro published [SOP Rules](#) for 2011 that fully explain eligibility, payment price and application process (BC Hydro, 2011b).

There are two eligibility rules of specific interest to the greenhouse industry. First, electricity must be generated either from clean or renewable resources or from a high-efficiency cogeneration facility. Second, the project site must be zoned appropriately if local government land-use requirements apply.

## 2.3 Economic Factors

The key driver for profitability of gas-fired cogeneration systems is the 'spark spread' (Figure 4), which is the margin between natural gas purchase price and electricity sale price (Daniels et al., 2007). The tipping point of profitability occurs when the selling price of electricity exceeds the price paid for natural gas by a margin that covers the costs of running the cogeneration system.

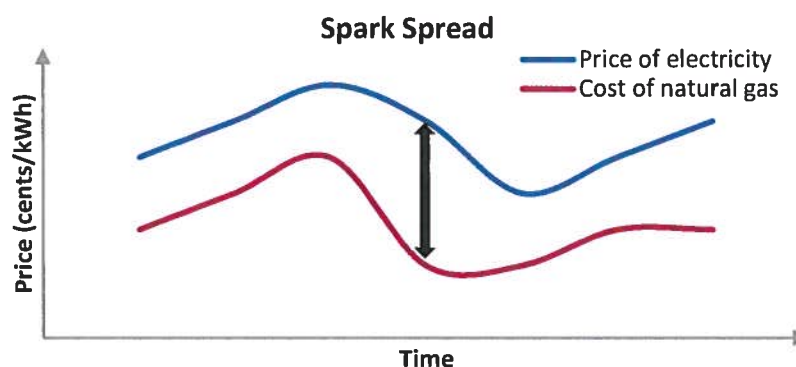


Figure 4. Spark spread between electricity and natural gas prices

The best example of how greenhouses maximize profits from cogeneration takes place in the Netherlands. Dutch greenhouse operators will only run their cogeneration engines when electricity prices are high and the 'spark spread' is the greatest. They store heat during that time and then operate back up boilers to meet heat demands when electricity prices are low. The Dutch have a liberalized energy market and the government has created substantial feed-in subsidies to support the cogeneration industry and achieve political targets for greenhouse gas reduction and improved energy efficiency.

The economics of cogeneration are different in British Columbia due to different costs and sources of fuel and electricity. BC currently relies on the cleanest and lowest cost electricity generation technology available worldwide. The volatility of gas prices in North America also means that there is a level of risk on the payback of investment in cogeneration. Recent volatility of natural gas prices and below market value of electricity has slowed the installation of cogeneration systems in Ontario (Nyboer et al., 2011). Greenhouse growers in BC also need to consider the carbon tax implications of consuming increased volumes of natural gas to fuel CHP engines.

In general, greenhouse vegetable operations in BC have not adopted high intensity supplemental lighting that would increase their electricity demand. In BC, supplemental lighting is more commonly used by floriculture greenhouses at levels of 4,000-10,000 lux (Willis Energy Services, 2005). Most of the electricity produced by on-farm cogeneration in BC would need to be sold to the grid because production would exceed greenhouse needs. The Willis Report concluded that cogeneration is viable for greenhouses in the Lower Mainland assuming that "the value of the electricity generated has a premium value because of its location at BC Hydro's load center, and gas distribution costs for the cogeneration facilities would be lower than Terasen's [FortisBC's] standard rates" (Willis Energy Services, 2005).

## 2.4 Technical Analysis of Cogeneration

Cogeneration is achieved through the use of CHP engines. CHPs simultaneously produce thermal and electric energy from a single fuel source, in this case natural gas. Heat from the engine cooling system and the exhaust gas is extracted by a heat exchanger and then used as a low temperature heat source in greenhouses (Daniels et al., 2007; Nyboer et al., 2011). CHP engines also release CO<sub>2</sub> that can be captured and used as a fertilizer in greenhouse operations.

### 2.4.1 Configuration

Figures 5 and 6 show how CHP engines can be connected to existing greenhouse infrastructure to supply heat, electricity and CO<sub>2</sub> to the facility. In practice, CHP engines will not completely replace natural gas boilers. A combination of the two systems will be necessary to maximize efficiencies and meet seasonal heat demands of the greenhouse.

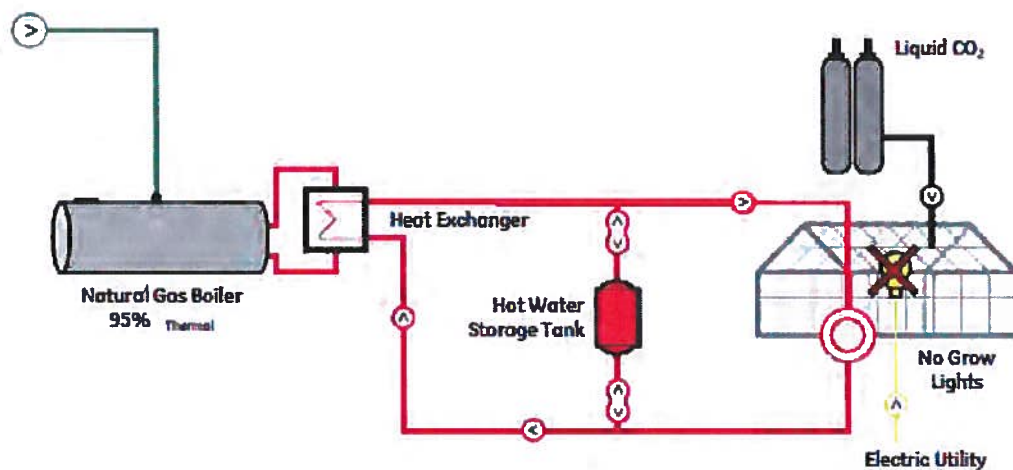


Figure 5. Existing greenhouse infrastructure with natural gas boiler and liquid CO<sub>2</sub> (Modak, 2011)

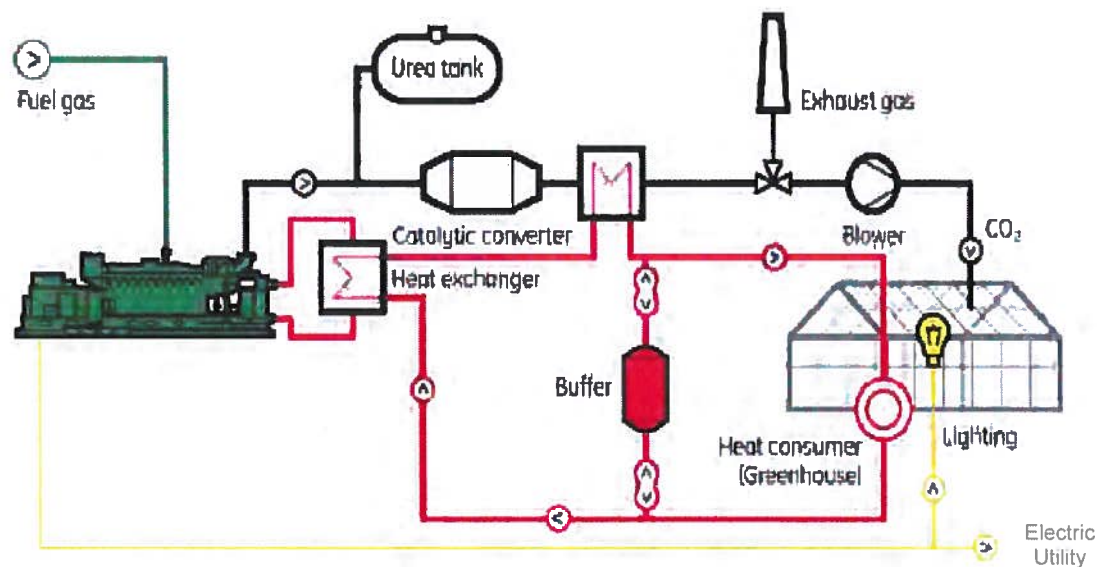
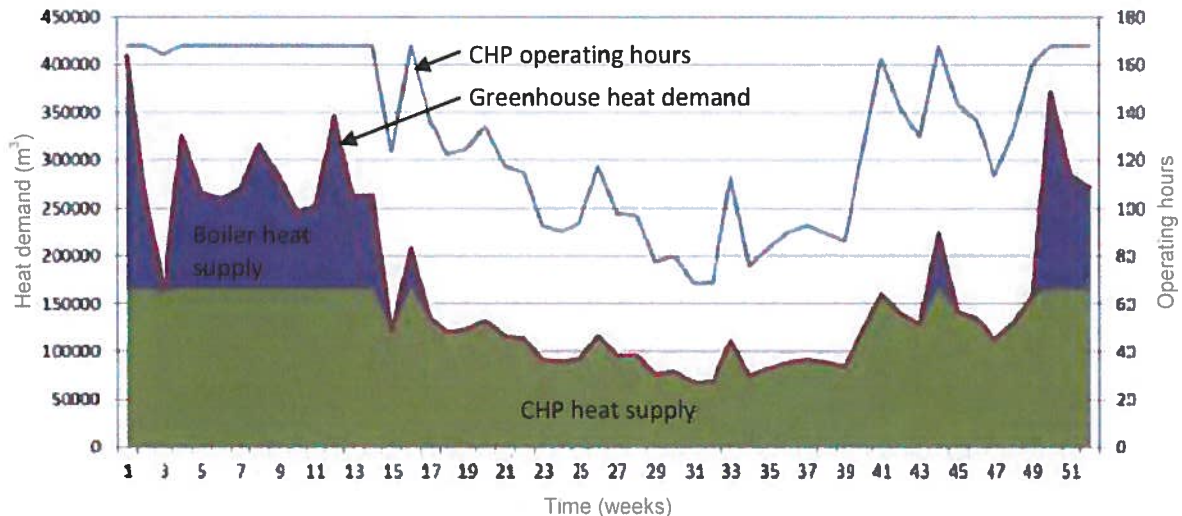


Figure 6. Heat, electricity and CO<sub>2</sub> supply to greenhouse by cogeneration (Kramp and Hesener, 2011)

## 2.4.2 CHP Sizing

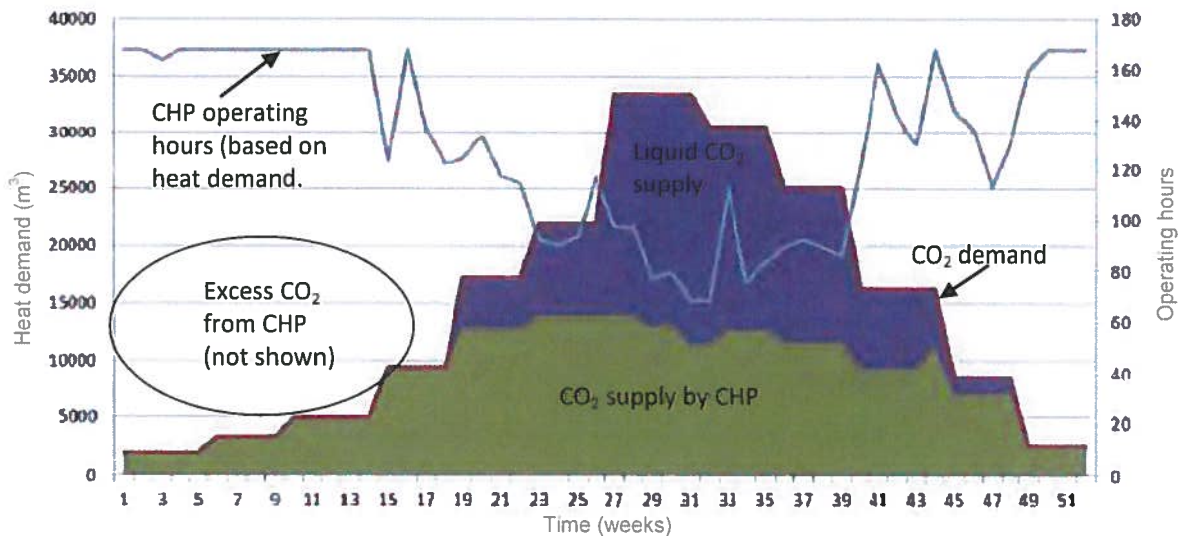
To maximize the benefits of cogeneration, the thermal capacity of the system should “be sized to meet the base thermal load required by the host facility” and electricity production should be maximized (Nyboer et al. 2011). It is not desirable to install a system with a higher power rating than required for the application because doing so would reduce the hours of operation and, therefore, the duration of CO<sub>2</sub> fertilizing per day (Hovius, 2010b). Figure 7 shows how an existing boiler and a CHP generator can be used in combination to meet the heat demand of a greenhouse tomato operation in the Lower Mainland. In this example, annual CHP operating hours are maximized and an existing boiler is used to meet seasonal heat demands.



**Figure 7.** Annual heat demand and CHP operating hours for tomatoes in the Lower Mainland (Kramp and Hesener, 2011)

Unfortunately, CO<sub>2</sub> demand at greenhouses does not correspond with heat demand. CO<sub>2</sub> demand is the greatest during summer months, when crops are growing rapidly and setting fruit. At this time, CHPs would be idled back because heat demand is lower, as seen in Figure 7. The result, as shown in Figure 8, is that liquid CO<sub>2</sub> would be necessary to meet CO<sub>2</sub> demand during the summer. When CHP operating hours are maximized, CO<sub>2</sub> demand of greenhouse crops is actually the lowest, meaning that excess CO<sub>2</sub> will be generated.





**Figure 8. Annual CO<sub>2</sub> supply and demand considering CHP operated to meet heat demand (Kramp and Hesener, 2011)**

In addition, the cogeneration system should be appropriately sized to minimize the capital costs. Cogeneration plants are a large capital investment and the cost of the plant is directly related to its size. The estimated capital cost for a cogeneration system in BC is \$1.4 million/MW electric installed (Kramp and Hesener, 2011). The industry will size and operate cogeneration systems efficiently due to the tight economics of the situation. Another major upfront cost is the interconnection fee to tie into BC Hydro's grid. It is often assumed to be less than 5% of the total capital cost, although the authors of the Willis Report acknowledged that the cost could exceed 25% of capital costs depending on the site (Willis Energy Services, 2005).

In 2008, the 'rule of thumb' for heat demand in the Netherlands was 0.5 MW electric per hectare when CO<sub>2</sub> fertilization is used but not grow lights (GE Energy, 2008). The greenhouse industry in B.C. has suggested that up to 1.5 MW electric per hectare would be required at peak load when grow lights are used. The cogeneration system should be sized based on the value of electricity and the operational demands for heat and CO<sub>2</sub>. A UBC master's thesis reported that the typical heat demand for floriculture crops was 6,250 GJ/ha and for vegetable crops was 24,000 GJ/ha (Chau, 2008).

### 2.4.3 Environmental Considerations

Cogeneration is considered to provide substantial gains in energy efficiency versus producing heat and energy separately (Nyboer et al., 2011; PEW Center, 2011). The reason for this is that thermal power stations commonly release the heat produced into the environment (Coyne, 1999). It has been estimated that two-thirds of the primary energy combusted in a power station is lost as waste heat (Henvey, 2006; Kerr, 2008). In contrast, cogeneration systems are very efficient and are commonly reported to convert 75% to 80% of the fuel into useful energy (Kerr, 2008). Modern systems being used by greenhouse operations around the world have even higher overall efficiencies of 90% or more (Kerr, 2008; Willis Energy Services, 2005).

Cogeneration is sometimes considered to reduce emissions of CO<sub>2</sub> (Nyboer et al., 2011) and other atmospheric pollutants (Coyne, 1999) when displacing energy produced by a thermal power station. It has been suggested that its efficiency at greenhouses is even greater because the CO<sub>2</sub> can be used for crop production (Willis Energy Services, 2005). For these reasons, some countries have provided incentives to increase the adoption of cogeneration systems as an approach to reduce greenhouse gas emissions and improve energy efficiency (van Berkum, 2009). In Europe, 15% of reductions in greenhouse gas emissions from 1990 to 2005 were achieved through increased use of cogeneration (Kerr, 2008).

Keep in mind that energy efficiency and greenhouse gas emissions are different categories of performance measurement. If cogeneration is considered to be highly efficient, compared to producing heat and electricity separately, it does not necessarily translate to reduced greenhouse gas emissions. A comparison must be made between current or baseline energy generating technology and cogeneration. In British Columbia, cogeneration at greenhouses is compared against hydro-electricity and existing thermal boilers. In most European countries and in the US, cogeneration at greenhouses is compared against coal-fired electricity and thermal boilers.

Given that the electricity supply in BC is dominated by a carbon neutral method like hydro, it is difficult to claim that cogeneration will decrease greenhouse gas emissions. Consider that CHP engines burn roughly twice as much fuel, compared to standard boilers, in order to produce the same amount of heat. Figure 9 demonstrates this situation and shows that doubling the fuel input also doubles the CO<sub>2</sub> output. In this example, switching from natural-gas fired boilers to CHP engines on farms in the Lower Mainland would actually increase greenhouse gas emissions. However, with increasing demand for electricity and a diminishing ability to build new dams in BC, the use of CHP systems may be preferable to the alternatives, such as importing coal-fired power from the U.S. In addition, the application of CHP systems will displace the need to truck bulk, liquid CO<sub>2</sub> to some greenhouse operations.

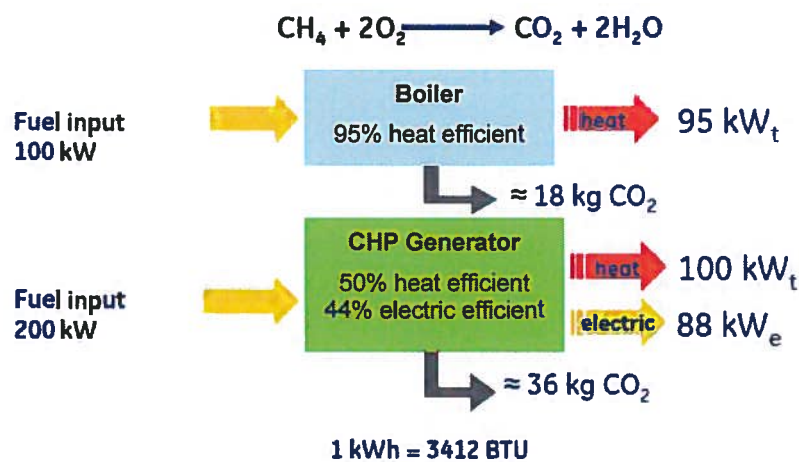


Figure 9. Fuel input and CO<sub>2</sub> output of CHP is twice that of boiler to produce similar heat (Kramp and Hesener, 2011)



## **2.6 Cogeneration in Other Jurisdictions**

Regulatory policies have helped to drive adoption of cogeneration in many parts of the world. For example, the Public Utilities Regulatory Policies Act (1978) and federal tax credits for cogeneration investments were responsible for a three-fold increase in cogeneration capacity in the US (PEW Center, 2011). The Energy Improvement and Extension Act of 2008 and the American Recovery and Reinvestment Act of 2009 further encourage adoption of cogeneration in the US (PEW Center, 2011). Some states also offer investment tax credits to help offset the capital costs of cogeneration investments (PEW Center, 2011). The situation is the same in many European countries. Government initiatives have played a major role in Europe achieving the highest proportion of cogeneration in the world (Brown and Robb, 2005).

Cogeneration is most attractive in regions with high electricity prices and good access to the electricity grid (Nyboer et al., 2011), and is less attractive in countries with a hydropower-based economy (Kerr, 2008). Cogeneration is most attractive to industries with high simultaneous demand for heat and electricity (Nyboer et al., 2011). The latter reason explains why 80% of electricity produced through cogeneration globally is represented by industrial sites in the chemicals, metal, oil refining, pulp and paper, and food processing sectors (PEW Center, 2011). Another advantage is the reliability of electricity supply; operations with a cogeneration system should not be impacted by failures in the transmission system (Henvey, 2006).

### **2.6.1 Canada**

There are more than 200 cogeneration systems in Canada with a total operating capacity of 9.1 GW<sub>e</sub>, which represents 7% of national electricity generation capacity (Nyboer et al., 2011). By comparison, cogeneration accounts for 12% of total electricity generating capacity in the US (PEW Center, 2011). Nearly 50% of the national capacity is located in Ontario, while BC ranks 3<sup>rd</sup> at 16% (Nyboer et al., 2011). The paper manufacturing sector accounts for 32% of the capacity, followed by the utilities sector at 23% (Nyboer et al., 2011). The first cogeneration systems were implemented by agricultural operations in the 1990s but today only account for 0.03% of national production capacity (Nyboer et al., 2011). Cogeneration systems have not been widely used by greenhouse operations in Canada.

Two years ago a 12 MW cogeneration plant (DDACE Power Systems, 2009) was installed at a 22 hectare greenhouse tomato operation in Ontario, Great Northern Hydroponics (UPI.com, 2009). The facility is reported to supply sufficient electricity to the grid to power up to 15,000 homes (UPI.com, 2009).

### **2.6.2 Europe**

Europe is a leader in the adoption of cogeneration. Cogeneration in Europe has been fostered by favorable government policies, the high cost of electricity, and interest to reduce greenhouse gas emissions and improve energy efficiency. Cogeneration accounts for about 11% of the heat and electricity needs in Europe (Nyboer et al., 2011), which is on par with the US. However, cogeneration accounts for 40% of electricity generation in Denmark, Finland, and the Netherlands (Brown and Robb, 2005).

In the Netherlands, cogeneration was first adopted by greenhouse growers in the 1980s as a means to provide electricity for grow lights (van Berkum, 2009). Cogeneration was chosen because on-site production of electricity is often cheaper than purchasing electricity in the Netherlands (Daniels et al., 2007). Greenhouse operations in the Netherlands have been early adopters of the technology and it has played a role in maintaining the competitiveness of the Dutch greenhouse vegetable industry (Kramp and Hesener, 2011). In 2009, greenhouses in the Netherlands produced about 2,700 MW of electricity, which was equal to roughly 10% of the total electricity produced in the country (Hovius, 2010a). Cogeneration is considered to be economically viable in the Netherlands for large-scale greenhouse operations that produce energy-intensive crops (Daniels et al., 2007).

After the liberalization of the electricity market in 2001, the Dutch government began providing incentives for cogeneration to revitalize the industry and meet national greenhouse gas and energy efficiency targets. Incentives were introduced in the form of long term agreements, feed-in subsidy schemes, energy tax exemptions, rebates, financing schemes and internal emissions trading systems. New development in agriculture was a response to changing electricity prices and profits from joint gas purchases and electricity trading services.

## Part 3 – Current Policies and Regulations

This section summarizes the roles, policies, and regulations of the government agencies that are likely to be involved with permitting on-farm cogeneration projects. These agencies include the ALC, MoE, local governments, and AGRI.

### 3.1 Agricultural Land Commission

Legislation guiding the activities of the ALC includes the *Agricultural Land Commission Act* (ALC Act) and the *Agricultural Land Reserve Use, Subdivision and Procedure Regulation* (ALRUSP Regulation). Neither of these statutes includes information about on-farm energy production systems specifically. Section 25 of the ALC Act allows applications for permission for non-farm use within the ALR.

Since the land use regulation under the *Agricultural Land Commission Act* does not currently permit this activity in the ALR, the Commission will consider this use as a non-farm use application. The ALC will endeavour to streamline these applications where the proposed use demonstrates support for and is clearly a benefit to the agricultural operation. While the proposed Ministry criteria are an important component to this initiative, they are not the ALC's criteria. However the Commission will use the standards as a guideline when considering non-farm use applications related to CHP facilities at greenhouses located in the ALR.

### 3.2 Ministry of Environment

Under the *Environmental Management Act (EMA)*, the *Waste Discharge Regulation* states that establishments engaged in the production of electricity by the combustion of fuel, and have a rated production of less than 5 megawatts under peak load do not require an authorization to discharge waste into the environment. The MoE intends to amend EMA to include facilities that have a rated production from 0.1 megawatts to 5.0 megawatts at peak load and develop a Code of Practice to regulate the discharge of waste into the Environment from these facilities. Facilities that have a rated production of greater than five megawatts would continue to be authorized and regulated by air and effluent permits (and *not* the code of practice).

### 3.3 Local Governments

Regional districts, municipalities, and other types of local governments have jurisdiction over various permits and processes that may be necessary for on-farm cogeneration projects. These include:

- Bylaw development, adoption, and enforcement;
- Building regulations including building codes and building permits.

In some cases, a zoning amendment may be required for an on-farm cogeneration project. However, the Ministry of Agriculture proposes that local governments not require a zoning amendment if the following conditions are met:

1. a Minister's Bylaw Standard for on-farm cogeneration is established;
2. the project meets the criteria within the standard;
3. the project is in the ALR or on land zoned for agriculture.

It is important for on-farm cogeneration project proponents to contact their local government early in their planning process to find out what steps they need to take.

### **3.4 Ministry of Agriculture**

Section 916 of the *Local Government Act* states that the Minister of Agriculture may establish, publish, and distribute standards to guide local governments in the preparation of bylaws for their farming areas. The Ministry's [Guide to Bylaw Development in Farming Areas](#) contains the standards that have been adopted as Minister's Bylaw Standards.

AGRI staff have engaged with on-farm cogeneration project proponents, technology providers and affected local governments. These stakeholders have indicated that a Minister's Bylaw Standard for on-farm cogeneration would facilitate the development of these projects. Therefore, the objective of this discussion paper is to propose a standard for adoption by the Minister of Agriculture as an official Minister's Bylaw Standard. This should assist local governments in developing bylaws affecting on-farm cogeneration projects.

### **3.5 Policies and Regulations in California and Ontario**

The existence of the ALR is something that makes BC different from other jurisdictions. In BC, various government agencies work collaboratively to ensure that farming remains the priority use in the ALR. Decisions regarding the development of policy incentives in BC are likely to be driven by this context in addition to economic and environmental benefit considerations.

The criteria presented in this discussion paper are intended to address land use issues and outline what is an acceptable farm use of cogeneration in the ALR. Research on regulations affecting cogeneration in other jurisdictions was therefore focused on aspects of sizing and operating the systems, rather than on energy policy.

#### **3.5.1 California Waste Heat and Carbon Emissions Reduction Act**

In 2007, the State of California enacted the Waste Heat and Carbon Emissions Reduction Act by passing Assembly Bill No. 1613. The bill stated the intent of the Legislature to: "(A) dramatically advance the efficiency of the state's use of natural gas by capturing unused waste heat, (B) to reduce wasteful consumption of energy through improved residential, commercial, institutional, industrial, and manufacturer utilization of waste heat wherever it is cost effective, technologically feasible, and environmentally beneficial, particularly when this reduces emissions of carbon dioxide and other carbon-based greenhouse gases, and (C) to support and facilitate both customer- and utility-owned combined heat and power systems."

The Act was added under Chapter 8: Energy Efficiency Systems to Part 2 of Division 1 of the Public Utilities Code. A "combined heat and power system" is defined in the Act is a system that produces both electricity and thermal energy for heating or cooling from a single fuel input that is (1) interconnected to, and operates in parallel with, the electric transmission and distribution grid, (2) is sized to meet the eligible customer-generator's onsite thermal demand, and (3) meets efficiency and greenhouse gas emissions standards set by the state. An "eligible customer-generator" is defined as a customer of

an electrical corporation that (1) uses a combined heat and power system with a generating capacity of not more than 20 megawatts and (2) uses a time-of-use meter capable of registering the flow of electricity in two directions.

Subdivision (a) of Section 2843 of the Act states that The Energy Commission shall, by January 1, 2010 adopt guidelines that combined heat and power systems (subject to the chapter) shall meet, and shall accomplish the following:

- (1) Reduce waste energy.
- (2) Be sized to meet the eligible customer-generator's thermal load.
- (3) Operate continuously in a manner that meets the expected thermal load and optimizes the efficient use of waste heat.
- (4) Are cost effective, technologically feasible, and environmentally beneficial.

Subdivision (e) of Section 2843 of the Act states that an eligible customer-generator's combined heat and power system shall meet the oxides of nitrogen (NO<sub>x</sub>) emissions rate standard of 0.07 lbs/MWh and a minimum efficiency of 60 percent. The minimum efficiency is calculated as useful energy output divided by fuel input and determined based on 100 percent load.

### **3.5.2 Ontario Power Authority – CHPSOP**

On November 23, 2010 the Minister of Energy directed the Ontario Power Authority (OPA) to procure 1000MW of CHP projects, less the approximate 500MW procured to date. The directive specified that new CHP projects shall consist of: individually negotiated contracts with projects over 20MW and a SOP for projects under 20MW.

With 500MW to be procured, the Clean Energy Standard Offer Program (CESOP) Initiative was developed to procure 200MW of small projects ( $\leq 20$  MW). Under the CESOP Initiative, 150MW projects were delegated to a Combined Heat and Power Standard Offer Program (CHPSOP) and 50MW were delegated to an Energy Recovery Standard Offer Program (ERSOP).

The CHP Directive specified that in undertaking procurement, the OPA shall consider the following factors:

- Projects shall be located in parts of the Province that the OPA identifies as appropriate;
- The cost effectiveness of the project;
- Whether the project can be accommodated by local distribution systems and whether there are local benefits associated with the project;
- Whether the project meets the technical requirements for CHP and is designed as an integral and financially viable source of supply to a heat load;
- The extent to which a project is sized to match the heat load requirements;
- A project's ability to accommodate electricity system load following and other operability requirements;

- Contract terms shall reflect a reasonable cost for Ontario electricity consumers and a reasonable balance of risk and reward between proponents and Ontario electricity consumers.

The CHPSOP is a financial contract between the OPA and the supplier. Contract terms are based on a Net Revenue Support Level (NRSL) in \$/MW-month and include physical obligations relating to Useful Heat Output (UHO), Capacity Test Checks and Availability. Contract terms are 20 years and the supplier must provide a metering plan (for both electrical and thermal metering) to the OPA for approval. The supplier is free to physically operate the CHP facility at its own discretion, but must pay a completion and performance security fee.

Contract payments are calculated monthly as the difference between a negotiated fixed capacity payment and imputed net revenue. The fixed capacity payment requires suppliers to meet a minimum usable heat output (UHO) of  $\geq 15\%$  from the 3<sup>rd</sup> contract year on and an average of  $\geq 15\%$  in the first 10 years of operation. If UHO requirements are not met, the NRSL component of the fixed capacity payment will be decreased by 1.33% for each 1.0% shortfall, based on a 5-year rolling average UHO shortfall. If there is a drop in UHO demand from the host facility, the supplier may terminate the contract and the facility must be shut down for the remainder of the term.

For each contract year, UHO is calculated as:

$$\frac{kWh_{thermal}}{kWh_{electrical} + kWh_{thermal}}$$

Where,

$kWh_{thermal}$  = annual net useful thermal energy produced as measured by thermal metering

$kWh_{electrical}$  = annual net electrical energy produced as measured by revenue meter

## Part 4 – Cogeneration – Criteria

### 4.1 Definitions

The following definitions are provided to clarify the meaning of certain words that are used in the criteria. The definitions are drawn or adapted from the *Farm Practices Protection (Right to Farm) Act*, 'Guide for Bylaw Development in Farming Areas', *BC Assessment Act*, and various local government bylaws.

<b>Cogeneration Facility</b>	includes the CHP engine and all additional components needed to achieve the production and transfer of heat and electricity from the engine to the greenhouse or interconnection site.
<b>CHP</b>	a combined heat and power engine that produces both electricity and thermal energy for heating or cooling from a single fuel input.
<b>CHP Efficiency</b>	useful energy output divided by fuel input, based on 100% load.
<b>Farm Class</b>	a designation given to a <i>lot</i> or part of a <i>lot</i> that is classified as "farm" under the BC Assessment Act.
<b>Farm Operation</b>	as defined under the " <i>Farm Practices Protection (Right to Farm) Act</i> " see Appendix B for complete definition.
<b>Farm Unit</b>	an area of land used for a <i>farm operation</i> consisting of one or more contiguous or non-contiguous <i>lots</i> , that may be owned, rented or leased, which form and are managed as a single farm.
<b>Greenhouse</b>	means a structure covered with translucent material and used for the purpose of growing plants, and which is of sufficient size for persons to work within the structure.

### 4.2 Criteria

Local governments are encouraged to incorporate these criteria into their bylaws. These criteria were developed for natural gas-fired cogeneration. Additional criteria may be required to address fuel storage and delivery for biomass-fired cogeneration or other fuel sources.

#### 1. Farm Class

- The farm *lot* where the *cogeneration facility* is to be located must be classified as 'farm' under the *BC Assessment Act*.
- Local governments may wish to ask for a copy of the farm's BC Assessment notice, as part of a building permit application.

#### 2. Fuel Type

- The CHP engine must be fueled by natural gas.

### 3. CHP Capacity

- The CHP must be sized to be commensurate with the heat demand of the farm operation.

### 4. Maximum CHP Capacity

- The CHP capacity must not exceed 1.0 MW<sub>e</sub>/ha of land in greenhouse crop production on the farm operation. A CHP engine with a capacity up to 1.5 MW<sub>e</sub>/ha is permitted if high intensity lighting (greater than 10,000 lux) is used in the greenhouse.

### 5. CHP Efficiency

- The CHP must operate with an efficiency of at least 80%.

### 6. Heat Storage

- The farm unit must have capacity to store excess heat generated by the CHP for beneficial use by the greenhouse.

### 7. Emissions

- The CHP must meet emission standards outlined in the *BC Environmental Management Act*.

### 8. Nuisance

- The CHP should be located and managed to minimize noise impacts on neighbours.

## 4.3 Discussion – pros and cons of the criteria

Criteria	Pros	Cons
Farm Class	<ul style="list-style-type: none"><li>• Limits <i>cogeneration</i> to bona fide farm operations.</li><li>• Reduces risk that the cogeneration facility is used for non-farm purposes.</li><li>• Easy requirement for farm to meet.</li></ul>	<ul style="list-style-type: none"><li>• This criterion alone is not adequate.</li></ul>
Fuel Type	<ul style="list-style-type: none"><li>• Municipalities and Regional Districts will determine whether or not other fuels are permitted for use with CHP systems.</li><li>• Allows natural gas fueled systems to proceed while additional criteria are developed for the other fuel types to address delivery, storage and combustion concerns.</li></ul>	<ul style="list-style-type: none"><li>• Greenhouse operators would require permission from the local government if they want to use a fuel other than natural gas.</li></ul>
CHP Capacity	<ul style="list-style-type: none"><li>• Ensures size of the cogeneration unit meets the thermal needs of the farm operation.</li><li>• Prevents wasting heat to benefit from the generation and sale of electricity beyond what is needed at the farm.</li><li>• Prevents over-sizing the cogeneration unit to a point where energy generation</li></ul>	<ul style="list-style-type: none"><li>• This criterion is subjective.</li></ul>



	becomes the primary activity taking place on the farm.	
<b>Maximum CHP Capacity</b>	<ul style="list-style-type: none"> <li>• 1.0 MW<sub>e</sub>/ha will meet the thermal and electricity demands of most greenhouses.</li> <li>• 1.5 MW<sub>e</sub>/ha will meet future thermal and electricity demands for greenhouses that use high intensity grow lights.</li> <li>• Avoids construction of excessively large power plants in the ALR.</li> <li>• Easy criterion to enforce.</li> </ul>	<ul style="list-style-type: none"> <li>• 1.5 MW<sub>e</sub>/ha is oversized today for most greenhouse applications.</li> <li>• Floriculture operations have highly variable thermal loads that may be much less.</li> <li>• BC Hydro's Standing Offer Program will be relied on to ensure that the CHP efficiency is at least 80%.</li> </ul>
<b>CHP Efficiency</b>	<ul style="list-style-type: none"> <li>• Ensures optimization of running hours to benefit the greenhouse operation.</li> <li>• Allows for flexibility to optimize the generation of heat, electricity or CO<sub>2</sub> based on crop needs and seasonal weather.</li> <li>• Based on industry reports of current installations running at &gt; 80% efficiency.</li> </ul>	<ul style="list-style-type: none"> <li>• Difficult criterion to monitor and enforce.</li> </ul>
<b>Heat Storage</b>	<ul style="list-style-type: none"> <li>• Allows for flexibility in run times and acts as buffer for heat usage.</li> <li>• Minimizes wasted heat when CHP is operating for electricity or CO<sub>2</sub> optimization.</li> </ul>	<ul style="list-style-type: none"> <li>• Difficult to provide specific heat storage requirements.</li> </ul>
<b>Emissions</b>	<ul style="list-style-type: none"> <li>• Ensures compliance with existing regulations.</li> </ul>	<ul style="list-style-type: none"> <li>•</li> </ul>
<b>Nuisance</b>	<ul style="list-style-type: none"> <li>• Minimizes nuisance concerns of CHP operation.</li> </ul>	<ul style="list-style-type: none"> <li>• Difficult to provide specific criteria.</li> </ul>

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