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BC Greenhouses and the Farm Energy Assessment Pilot Project

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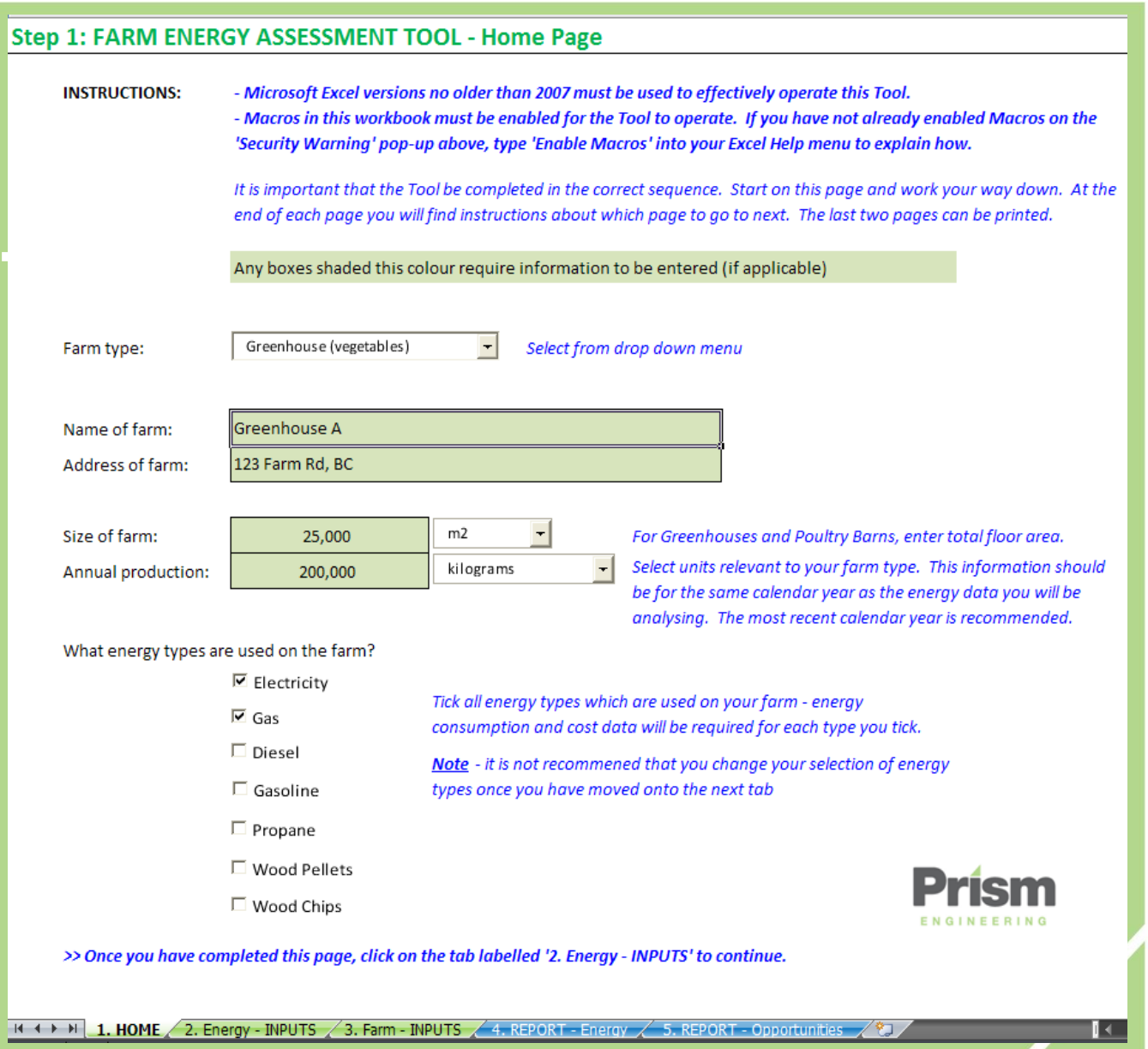
BCFEA Tool

- BC Farm Energy Assessment (BCFEA) Tool
- Objective – *To provide a mechanism for farms to assess potential energy management opportunities specific to their operation at a high-level.*
- BCFEA Tool is Excel based, has inputs (questions) and produces outputs (reports) summarizing the recommendations for energy management opportunities.
- BCFEA Tool is still in development stage (Emily to talk more on this shortly)
- All 27 farms assessed by Prism were analyzed using the BCFEA Tool, including 11 greenhouses

The Assessment Process

1. Background research and literature review
2. Contact growers to obtain preliminary information
3. Site visit – approx ½ day per farm
   - Review historic energy data,
   - Discuss farming process specific to each grower,
   - Site tour of all energy related equipment (focus on heating plant),
   - Identification of energy management opportunities.
4. Development of the BCFEA Tool
5. Assessment of farms using BCFEA Tool
6. Individual farm reports

Inputs…



Step 1: FARM ENERGY ASSESSMENT TOOL - Home Page

INSTRUCTIONS:

- Microsoft Excel versions no older than 2007 must be used to effectively operate this Tool.
- Macros in this workbook must be enabled for the Tool to operate. If you have not already enabled Macros on the 'Security Warning' pop-up above, type 'Enable Macros' into your Excel Help menu to explain how.

It is important that the Tool be completed in the correct sequence. Start on this page and work your way down. At the end of each page you will find instructions about which page to go to next. The last two pages can be printed.

Any boxes shaded this colour require information to be entered (if applicable)

Farm type: Greenhouse (vegetables) — *Select from drop down menu*

Name of farm: Greenhouse A

Address of farm: 123 Farm Rd, BC

Size of farm: 25,000 m2

Annual production: 200,000 kilograms

For Greenhouses and Poultry Barns, enter total floor area.
Select units relevant to your farm type. This information should be for the same calendar year as the energy data you will be analysing. The most recent calendar year is recommended.

What energy types are used on the farm?

- [x] Electricity
- [x] Gas
- [ ] Diesel
- [ ] Gasoline
- [ ] Propane
- [ ] Wood Pellets
- [ ] Wood Chips

Tick all energy types which are used on your farm - energy consumption and cost data will be required for each type you tick.

***Note** - it is not recommened that you change your selection of energy types once you have moved onto the next tab*

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>> Once you have completed this page, click on the tab labelled '2. Energy - INPUTS' to continue.

1. HOME | 2. Energy - INPUTS | 3. Farm - INPUTS | 4. REPORT - Energy | 5. REPORT - Opportunities

Step 2: FARM ENERGY - Inputs

Year of energy data: 2010 *Please enter e.g. if the calendar year you are looking at is 2009, enter '2009' into this box.*

ENERGY CONSUMPTION

Enter energy consumption data in the table below for the year you are analysing:

Only enter data for energy types used on the farm. This includes fuel used for vehicles and machinery.
If consumption and/or cost are not known by month, enter the annual total in the 'Annual (if monthly unknown)' cells at the bottom of each table. Select units where a drop-down option box is shown

	Electricity (kWh)	Gas GJ
Jan	1,400,000	9,000
Feb	1,400,000	7,000
Mar	1,500,000	8,000
Apr	1,500,000	7,000
May	1,500,000	6,500
Jun	1,200,000	6,000
Jul	1,150,000	5,000
Aug	1,100,000	5,500
Sep	1,050,000	6,000
Oct	1,100,000	7,000
Nov	1,200,000	7,500
Dec	1,300,000	8,000
Annual (if monthly is unknown)		

ENERGY COST

Enter energy cost data in the table below for the year you are analysing:

	Electricity ($)	Gas ($)
Jan	$ 56,000	$ 72,000
Feb	$ 56,000	$ 56,000
Mar	$ 60,000	$ 64,000
Apr	$ 60,000	$ 56,000
May	$ 60,000	$ 52,000
Jun	$ 48,000	$ 48,000
Jul	$ 46,000	$ 40,000
Aug	$ 44,000	$ 44,000
Sep	$ 42,000	$ 48,000
Oct	$ 44,000	$ 56,000
Nov	$ 48,000	$ 60,000
Dec	$ 52,000	$ 64,000
Annual (if monthly is unknown)		

Step 3: Greenhouse (vegetables) - Inputs

Select the appropriate answer from each of the drop-down boxes, starting at the top of the page.

MOBILE EQUIPMENT

1	Are vehicles / mobile equipment used on the farm?	No

GREENHOUSE BUILDING AND CONSTRUCTION

1	How leaky is your greenhouse(s) on a scale of 1 to 5? (where 1 is not leaky at all and 5 is very leaky)	1
2	If crops are grown above floor-level, are perimeter walls insulated below bench height?	N/A

GREENHOUSE HEATING SYSTEMS

1	Approximately what percentage of the farm's total energy consumption for each energy type listed to the right is used for Greenhouse heating?	Gas	100%
		Diesel	
		Propane	
		Wood Pellets	
		Wood Chips	

Enter the percentage(s) into the boxes shown for any energy types which are used for Greenhouse heating. Leave blank for energy types which are not used. Each value can be between 0% and 100%.
E.g. if all gas is used for heating, and 80% of your wood chips are used for heating, enter 100% for gas, and 80% for wood chips.

2	How is your greenhouse(s) heated?	Hot water boiler/s
3	If multiple boilers are used, are standby boilers isolated by shutting off supply and return valves when not in use?	No
4	If boilers are used, how often do you have a flue-gas test (tuning) conducted?	Annually or more
5	If boilers are used, is a flue-gas economizer (condenser) used to recover heat from your primary boiler's flue gas?	No
6	Do you feed CO_2 into your greenhouse to promote photosynthesis?	Yes
7	If you use boiler flue gas to provide CO_2 for your greenhouse(s), do you also use a hot water storage tank to store the heat which is generated during the daytime?	Yes

Outputs…

BC Farms Energy Assessment Tool

FARM ENERGY ASSESSMENT RESULTS - Part A

Farm Information

Farm: Greenhouse A
Addres 123 Farm Rd, BC
Type: Greenhouse (vegetables)

Energy Information

Year 2010

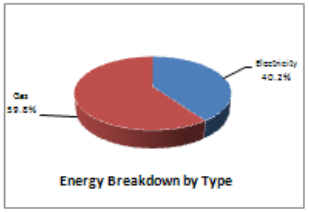
Energy Consumption Summary

Energy Sou	Raw Data Consumption	Units	Equivalent kWh ekWh/yr	Unit Cost $/ekWh	Annual Cost $/yr	GHG ons eCO2/
Electricity	15,400,000	kWh	15,400,000	$0.040	$616,000	463
Gas	82,500	GJ	22,916,667	$0.029	$660,000	4,114
Total	-	-	**38,316,667**		**$1,276,000**	**4,583**

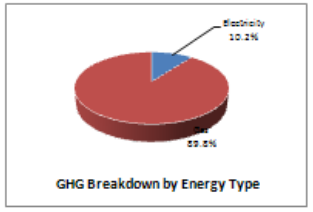
Key Performance Indicators

		Your Farm	Average for farm	Units	% above (+) or below (-)
Energy KPI	**Area**	1,533	558	ekWh/m2	175%
	Production	132	N/A	ekWh/kilograms	N/A
GHG KPI	**Area**	0.183	0.089	tons eCO2/m2	106%
	Production	0.0229	N/A	tons eCO2/kilograms	N/A

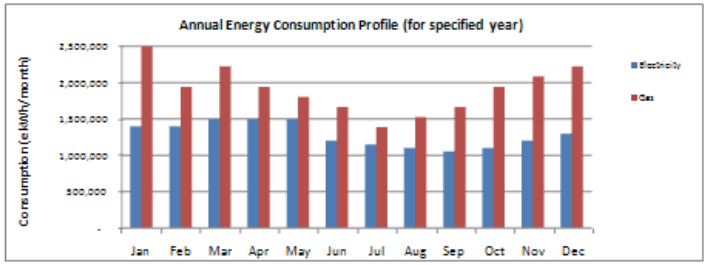
**Based on a sample size of 7 farms of this type studied in BC*



Energy Breakdown by Type



GHG Breakdown by Energy Type



Part A - Energy Results

FARM ENERGY ASSESSMENT RESULTS - Part B

Farm Information

Farm: Greenhouse A
Address: 123 Farm Rd, BC
Farm type Greenhouse (vegetables)

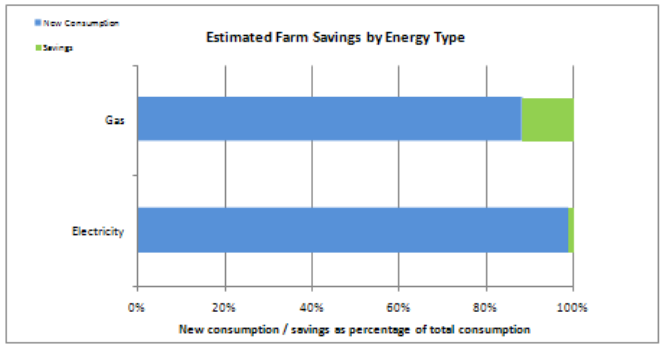
Potential Savings

Disclaimer: The savings shown below are estimates based on studies conducted on similar farms. The values shown will help to determine which energy management opportunities should be pursued in more detail.

Energy Savings Summary

	Estimated Savings				
Energy Type	**kWh/yr**	**Savings %***		**$/yr**	**tons eCO2/yr**
Electricity	190,090	1.2%	$	7,600	5.79
Gas	2,750,000	12.0%	$	79,200	493.66
Total	**2,940,090**	**7.7%**	**$**	**86,800**	**499.45**

*Shown as a percentage of total farm energy use



Energy Management Opportunities

The following describes the potential energy management opportunities for each category and their priority level for implementation, when known to a reasonable confidence level:

Priority level key:		
	HIGH	Quick payback period, typically less than 2 yrs
	MEDIUM	Medium payback period, typically 2-5 yrs
	LOW	Longer payback period, typically greater than 5yrs
	VARIABLE	Unknown payback, cost and/or savings can vary considerably

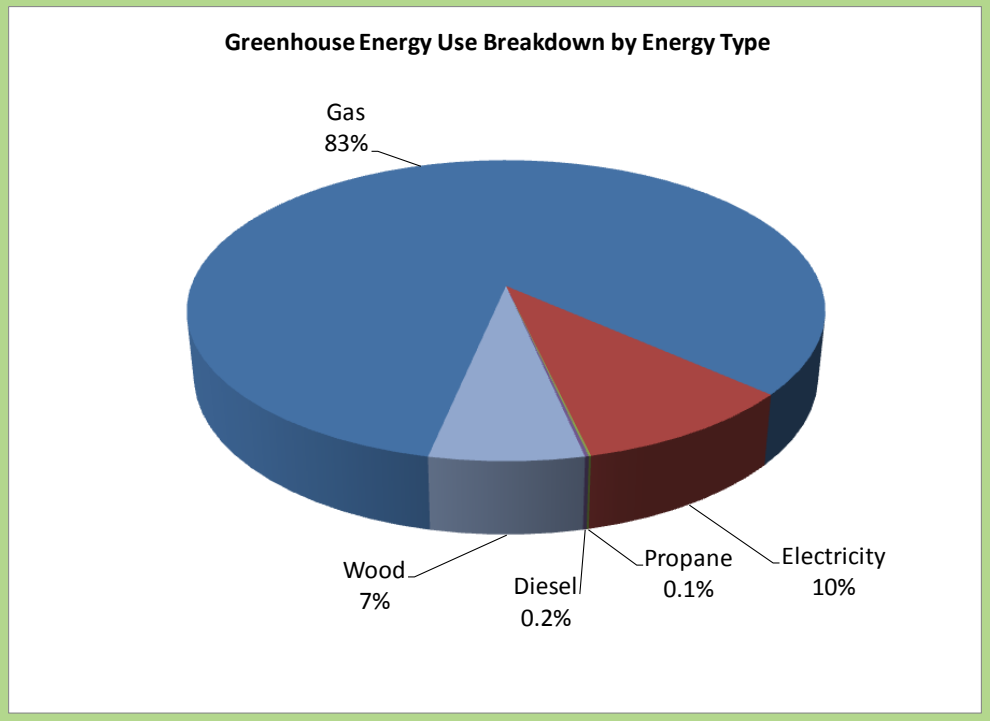
** Paybacks are likely to vary between sites. It is recommended that a more detailed energy savings analysis and a quote for work is obtained before proceeding with any project. Note that financial incentives are not included in the analysis.*

Greenhouse Heating Systems	**Savings $ 79,700 /yr**
- If possible, ensure standby boilers are isolated by shutting off supply and return valves when not in use. If standby boilers cannot be fully isolated, consider reducing flow through the standby boiler in order to save pumping energy.	HIGH
- Install a flue-gas economizer (condenser) to recover heat from your primary boiler exhaust.	VARIABLE
- When replacing pumps at end of life, ensure new pumps use high efficiency motors.	VARIABLE
- Install retractable curtains on the remaining area of your greenhouse(s) to realise additional energy savings.	VARIABLE

Lighting	**Savings $ 7,020 /yr**
- Use lighting controls such as time-clocks or occupancy sensors to shut off lighting when not needed.	VARIABLE
- Retrofit T12 8' 110 watts fluorescent tubes to T8 4' 32 watts fluorescent tubes + HBF electronic ballast	LOW

Findings – Energy Use

- Average 2009 energy use intensity for vegetable greenhouses of **1.94 eGJ/m^2**
- Breakdown by energy type below…



Findings – EMO's

- Common energy management opportunities for greenhouses included:
  - Disable heating water zone pumps unless there is a need for heating in the zone;
  - Repair greenhouse glazing leaks;
  - Insulate bare sections of heating distribution pipes;
  - Install power factor correction equipment;
  - Replace T12 fluorescent lighting with more efficient T8 lamps and ballasts.

Findings – EMO's

- Other energy management opportunities for greenhouses included:
  - Isolate standby boilers,
  - Install heat recovery section (condenser) on primary boiler exhaust,
  - Increase capacity of hot water storage (CO_2 production),
  - Install retractable thermal/shade curtain (crop dependent),
  - Install lighting controls.

Savings

- Approximate combined savings for the 11 greenhouses assessed using the BCFEA Tool:
  - 57,000 eGJ/yr (elec + fuels)
  - $500,000 /yr in savings
  - 2,800 tons/yr CO_2 emissions
  - Energy savings varied considerably from site to site (<1 – 28%)

  – Large range of payback periods for measures identified
  – Working on closing the gap between costs and incentives…
  – Producers should still investigate recommendations in more detail prior to making a final decision

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