

# Horticultural Services, Inc.

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Mr. Peter Siderius

The following comparisons for energy use are made using typical structural options at Newberg High School. I have generated multiple reports making multiple assumptions so that you can see how costs shift depending upon the use of different Glazings, a Heat Retention Curtain, and / or an automatic night-setback Integrated controller.

The program calculates uses actual typical daily temperatures and solar heating influx for the Portland area.

There are lots of combinations here in an attempt to play the game of "pay-now, or Pay-later" Capital Improvements can reduce annual expenses.

If you consider an Energy Curtain installed may cost about \$ 11,000 and the annual savings under corrugated polycarbonate can be \$ 2,861 the straight payback is about four years. Add in a possible B.E.T.C. Tax credit of 25% and the payback is three years.

A simple digital computerized control makes the difference between \$ 8,929 and \$ 7,449. Hence – even an advanced control can pay back in less than two to three years and will provide significant educational experience.

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## **WITHOUT HEAT RETENTION CURTAIN**

### **WITHOUT NIGHT SET-BACK**

#### **Corrugated Polycarbonate Glazing**

Newberg HS 7500: Triangular: 60 ft x 36 ft

##### Heating Schedule

Jan 1 to Mar 15 Constant Temperature: 50 °F

Mar 16 to Jun 30 Constant Temperature: 65 °F

Jul 1 to Aug 31 Constant Temperature: 40 °F

Sep 1 to Dec 31 Constant Temperature: 65 °F

Heating Efficiency: 48% Gas Unit Heaters

Air Exchanges: 0.65 exchanges/hour

##### Fuel Types and Prices

Newberg HS 7500: Natural Gas at **\$1.31** per therm

Total Heating Costs: **\$ 8,929**

Total Heating Cost per Square Foot: \$ 4.13

Maximum BTU Draw on All Heaters: 235,118 BTU/hour

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## **WITH HEAT RETENTION CURTAIN WITHOUT NIGHT SET-BACK Corrugated Polycarbonate Glazing**

Newberg HS 7500: Triangular: 60 ft x 36 ft, with energy curtain  
Heating Schedule

Jan 1 to Mar 15	Constant Temperature: 50 °F
Mar 16 to Jun 30	Constant Temperature: 65 °F
Jul 1 to Aug 31	Constant Temperature: 40 °F
Sep 1 to Dec 31	Constant Temperature: 65 °F

Total Heating Costs: **\$ 6,068**  
Total Heating Cost per Square Foot: \$ 2.81  
Maximum BTU Draw on All Heaters: 210,898 BTU/hour

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## **WITHOUT HEAT RETENTION CURTAIN WITH NIGHT SET-BACK of 5 degrees at sunset during heating season. Corrugated Polycarbonate Glazing**

Newberg HS 7500: Triangular: 60 ft x 36 ft  
Heating Schedule

Jan 1 to Mar 15	Constant Temperature: 50 °F
Mar 16 to Jun 30	<b><u>During the Day: 65 During the Night: 60 °F</u></b>
Jul 1 to Aug 31	Constant Temperature: 40 °F
Sep 1 to Dec 31	<b><u>During the Day: 65 During the Night: 60 °F</u></b>

Total Heating Costs: **\$ 7,449**  
Total Heating Cost per Square Foot: \$ 3.45  
Maximum BTU Draw on All Heaters: 210,898 BTU/hour

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## **WITH HEAT RETENTION CURTAIN WITH NIGHT SET-BACK of 5 degrees at sunset during heating season. Corrugated Polycarbonate all over**

Newberg HS 7500: Triangular: 60 ft x 36 ft, with energy curtain  
Heating Schedule

Jan 1 to Mar 15	Constant Temperature: 50 °F
Mar 16 to Jun 30	<b><u>During the Day: 65 During the Night: 60 °F</u></b>
Jul 1 to Aug 31	Constant Temperature: 40 °F
Sep 1 to Dec 31	<b><u>During the Day: 65 During the Night: 60 °F</u></b>

Total Heating Costs: \$ 5,261  
Total Heating Cost per Square Foot: \$ 2.44  
Maximum BTU Draw on All Heaters: 210,898 BTU/hour

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## **WITH HEAT RETENTION CURTAIN**

**WITH NIGHT SET-BACK of 5 degrees at sunset during heating season.**

**WITH Twin-Wall Polycarbonate Roof , sides and ends..**

Newberg HS 7500: Triangular: 60 ft x 36 ft, with energy curtain

### Heating Schedule

Jan 1 to Mar 15	Constant Temperature: 50 °F
Mar 16 to Jun 30	<u>During the Day: 65 During the Night: 60 °F</u>
Jul 1 to Aug 31	Constant Temperature: 40 °F
Sep 1 to Dec 31	<u>During the Day: 65 During the Night: 60 °F</u>

Total Heating Costs:	<b>\$ 2,882</b>
Total Heating Cost per Square Foot:	\$ 1.33
Maximum BTU Draw on All Heaters:	119,060 BTU/hour

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## **WITHOUT HEAT RETENTION**

**WITH NIGHT SET-BACK of 5 degrees at sunset during heating season.**

**WITH Twin-Wall Polycarbonate Roof , sides and ends.**

Newberg HS 7500: Triangular: 60 ft x 36 ft

### Heating Schedule

Jan 1 to Mar 15	Constant Temperature: 50 °F
Mar 16 to Jun 30	<u>During the Day: 65 During the Night: 60 °F</u>
Jul 1 to Aug 31	Constant Temperature: 40 °F
Sep 1 to Dec 31	<u>During the Day: 65 During the Night: 60 °F</u>

Total Heating Costs:	<b>\$ 3,944</b>
Total Heating Cost per Square Foot:	\$ 1.83
Maximum BTU Draw on All Heaters:	119,060 BTU/hour

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## **WITHOUT HEAT RETENTION CURTAIN**

**WITHOUT NIGHT SET-BACK of 5 degrees at sunset during heating season.**

**WITH Twin-Wall Polycarbonate Roof , sides and ends.**

Newberg HS 7500: Triangular: 60 ft x 36 ft

Jan 1 to Mar 15	Constant Temperature: 50 °F
Mar 16 to Jun 30	Constant Temperature: 65 °F
Jul 1 to Aug 31	Constant Temperature: 40 °F
Sep 1 to Dec 31	Constant Temperature: 65 °F

Total Heating Costs:	<b>\$ 4,792</b>
Total Heating Cost per Square Foot:	\$ 2.22
Maximum BTU Draw on All Heaters:	134,671 BTU/hour

Reports generated using USDA ARS "*Virtual Grower 1.10*"

**Application Technology Research Unit- Greenhouse Production Research Group**

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## Energy Use comparison, *instantaneous heat loss at one point in time.*

### Greenhouse Dimensions

Length: 60 ft    Width: 36 ft  
Side Height: 10 ft  
Kneewall Height: 0 ft  
Peak Height: 19 ft  
Number of Spans: 1    Peaks per Span: 1    Roof Shape: Triangular

### Greenhouse Materials

Roof: Corrugated Polycarbonate  
North Wall: Corrugated Polycarbonate  
South Wall: Corrugated Polycarbonate  
East Wall: Corrugated Polycarbonate  
West Wall: Corrugated Polycarbonate  
No Kneewall  
Air Exchange Rate: 1

### Heating Specifications

Fuel Type: Natural Gas  
Fuel Cost: 1.31 per  
Heater Efficiency: 0.55  
Using An Energy Curtain: No

### Environment

Greenhouse Temperature: 65 F  
Outside Temperature: 35 F  
Wind Speed: 0 mph  
Solar Radiation: 0 Wh / ft<sup>2</sup>

### Calculated Values:

Using An Energy Curtain:>>>>	<u>No</u>	<u>Yes</u>
BTU lost per hour:	<b>186,514</b>	<b>114,246</b>
Cost per Hour:	<b>\$ 3.33</b>	<b>\$ 2.06</b>