



# SOLAR WATER HEATING AT DELTA TECH OPS

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EAS 3110: Energy, Environment, and Society, Professor Kim Cobb



## Background

In 2015, Delta airlines purchased 2 million metric tons of Carbon offsets to maintain their goal of carbon neutral growth. Our goal was to find an opportunity to decrease carbon emissions at their technical operations center.

## The Problem

Currently, boiling water for washing plane engine parts is done by Natural Gas water boilers, which is carbon inefficient.



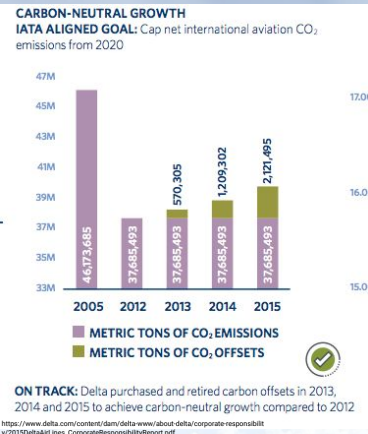
## Solution → Solar Water Heating

- Install solar water heaters to replace Natural Gas Water Boilers
- Contacted officials at Delta and Solar America Solutions
- Received from Delta:
  - 0.565 \$/therm
  - 12,500 gallons/ day
  - 105 F heating temperature
- Received from Solar America Solutions:
  - 35,000 Btu/hour per panel
  - Can heat 321 gallons/day by 105 F
  - 10 year warranty



## Acknowledgments:

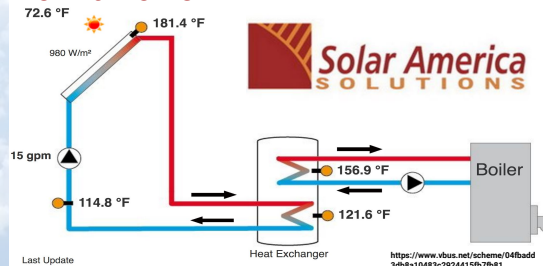
Our proposal wouldn't have moved forward without the help of Steve Tochilin and Wesley Parkmond from Delta Ops and Don Cawmmer from Solar America Solutions.



## Why Solar Water Heating?

- High carbon and monetary cost of natural gas heating
- Claim carbon offsets
- Relatively fast ROI
- High demand for heating at Delta due to boiler systems

## How It Works



The heat from the sun is collected by refrigerant in the panels then circulated to the heat exchanger. The heat is then transferred to the water in the boiler.

## References:

1. Business Energy Investment Tax Credit (ITC). Retrieved April 26th, 2017, from <https://energy.gov/savings/business-energy-investment-tax-credit-itc>
2. Climate Policy Initiative. (n.d.). California Carbon Dashboard. Retrieved April 27, 2017, from <http://carbondash.org/>
3. Delta Air Lines. (2015). 2015 Corporate Responsibility Report. Retrieved from [http://www.delta.com/content/dam/delta-www/about-delta/corporate-responsibility/2015DeltaAirLines\\_CorporateResponsibilityReport.pdf](http://www.delta.com/content/dam/delta-www/about-delta/corporate-responsibility/2015DeltaAirLines_CorporateResponsibilityReport.pdf)
4. Greenhouse Gases Equivalencies Calculator - Calculations and References. (2017, January 24). Retrieved April 26, 2017, from <https://www.epa.gov/energy/greenhouse-gases-equivalencies-calculator-calculations-and-references>
5. Overview of Greenhouse Gases. (2017, April 14). Retrieved April 26, 2017, from <https://www.epa.gov/ghgemissions/overview-greenhouse-gases>
6. Wue, S. (n.d.). Georgia Gas Markets' Price Chart. Retrieved April 27, 2017, from <http://www.psc.state.ga.us/content.aspx?c=2F&gas-market-pricing%2F2014%2FApril-2014-pricing%2F>



**Total Money Savings: \$146,053**

## Natural gas savings:

2,124.28 therm/month  
X \$0.565/therm  
X 120 months (10 years)  
**\$144,026 saved**

## Carbon Offset savings:

11.26 tonne CO<sub>2</sub>/month  
x \$1.5/tonne CO<sub>2</sub>  
x 120 months (10 years)  
**\$2,027 saved**



<http://www.boeing.com/commercial/customers/delta-airlines>

Quote from Solar America Solutions:

\$152,155 for 25 panels  
After Federal Tax Credit for 30%:  
Actual Cost: **\$106,508**

Water supply per unit = 321 (gallon)/(day-unit)  
65% Water demand= 8125 gallons/day  
**Need= (Demand/Supply)= 25 Units**

## Total Carbon Savings:

2,124 therms/month (currently N.G. Boilers)  
X 11.69 lb CO<sub>2</sub>/therm  
X 120 months  
**2,979,687 lbs CO<sub>2</sub>**

## ROI

- Dependent on natural gas (NG) prices
- **7.3 years** based on 2017 NG prices and Carbon offsets
- **3.4 years** based on 2014 NG prices (\$1.15/therm) and nationwide carbon price equal to CA's (\$12.95/tonne CO<sub>2</sub>)

**Carbon Savings ~  
Weight of 20 Boeing-737 planes**

## Meatless Earth Day Challenge

We created an online survey to encourage people to give up various types of meat for a specified length of time.

1 Serving = 4 oz  
1 serving of beef = 11.37 lb CO<sub>2</sub>  
1 serving of pork = 1.45 lb CO<sub>2</sub>  
1 serving of chicken = 0.714 lb CO<sub>2</sub>

159 Responses (93% Participation)  
**Total Servings Given Up :**  
888 beef, 420 pork, 468 chicken

## Why is meat so carbon intensive?

Resource intensive = Carbon intensive

Ex: Broiler (Poultry) in US, CO<sub>2</sub>e Composition

- Feed - 82.4%
- On-farm (Heating/Ventilation) - 16%
- Hatchery Chicks - 1.6%

**Total Carbon Savings:**  
**11,037 lbs of CO<sub>2</sub>**

## References:

1. Pelletier, Environmental performance in the US broiler poultry sector: Life cycle energy use and greenhouse gas, ozone depleting, acidifying and eutrophying emissions, Agricultural Systems, Volume 98, Issue 2, September 2008, Pages 67-73, ISSN 0308-521X, <https://doi.org/10.1016/j.agsy.2008.03.007>
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3. Pelletier, N., Pirog, R., Rasmussen, R., 2010b. Comparative life cycle environmental impacts of three beef production strategies in the Upper Midwestern United States. Agric. Syst. 103, 380-389
4. Greenhouse Gas Emissions from a Typical Passenger Vehicle. (2016, November 21). Retrieved April 24, 2017, from <https://www.epa.gov/greenvehicles/greenhouse-gas-emissions-typical-passenger-vehicle0C>