

# SOLAR FEASIBILITY ANALYSIS FOR THE WESLEY UNITED METHODIST CHURCH

WPI – 2009

# Meet the Team:

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- Brian Bates, CS major from Westport, MA
- Dillon Buchanan, ECE major from Marstons Mills, MA
- Stephen Mueller, ECE major from Freetown, MA
- Thomas Parenteau, CE major from Scarborough  
Maine

# The Project

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- Church is burdened by high electricity bills
- IQP – Group of students work on a community related project

# The Project

- Problem Statement: To determine the economic feasibility of a solar panel installation at Wesley United Methodist Church and to explore its societal benefits.
  - Site Analysis
  - Economic Incentives
  - Scenarios
  - Social Benefits
  - Recommendations

# Solar Panel



# Site Analysis

- Average monthly electricity usage: 9,500 kWh, or \$1,300
- Total usable space: 4,400 sq ft of flat roof
- The flat roof has mostly southern exposure
- Maximum roof weight is 35lb/sqft

# Site Analysis

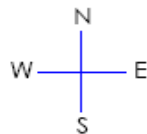
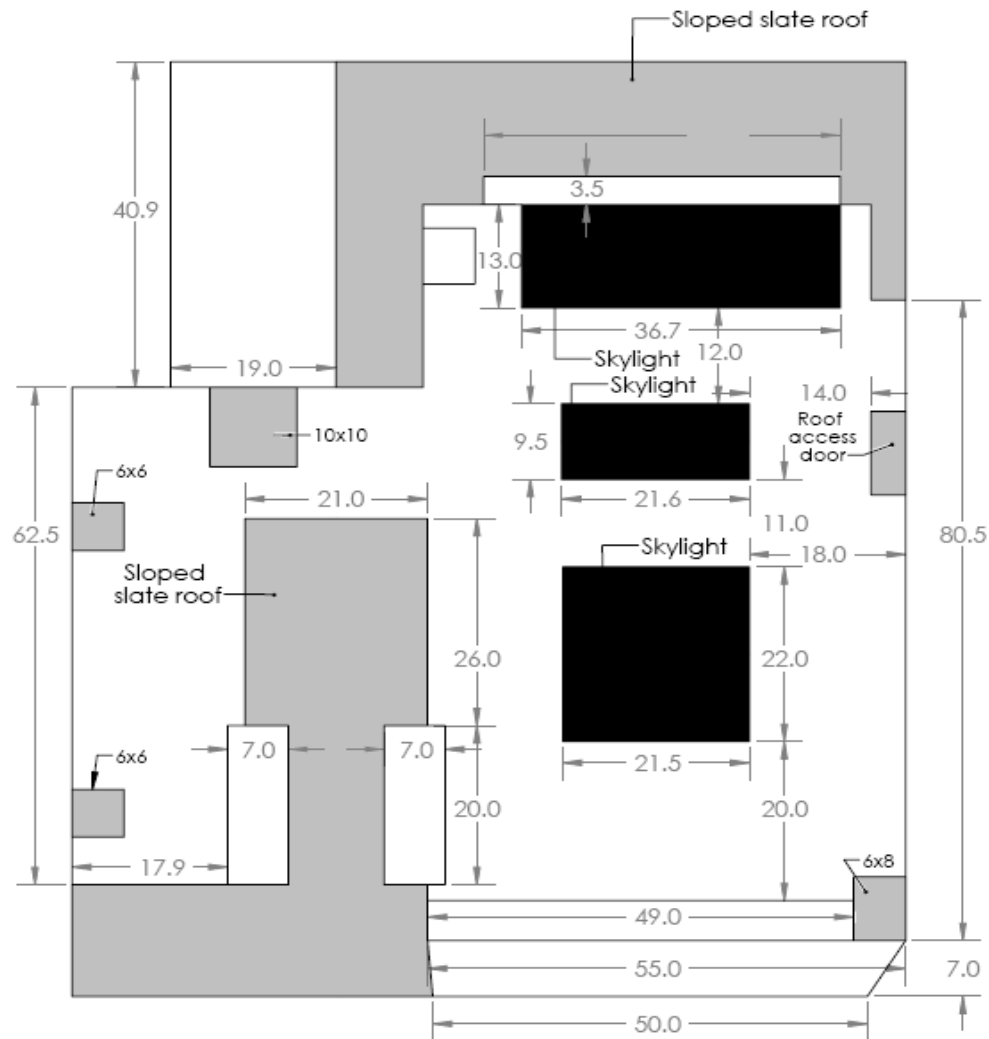




# Site Analysis







**NOTES:**

- All dimensions in feet
- All shaded areas are unusable for mounting solar panels
- All White areas are flat rubber roof surfaces

Thomas Parenteau	
TITLE: Wesley United Methodist Church Flat Roof Area	
SHEET NO. <b>A</b>	1 of 5
SCALE: 1:200	11-20-2008

# Economic Incentives Available

- Most incentives take the form of tax breaks:
  - ▣ No sales tax on purchase of components
  - ▣ Deductions from property tax
- However, there are rebates available through Commonwealth Solar
  - ▣ \$3.25 per Watt deduction for systems under 25kW
  - ▣ Extra \$0.25 if components made in MA

# Available Sunlight

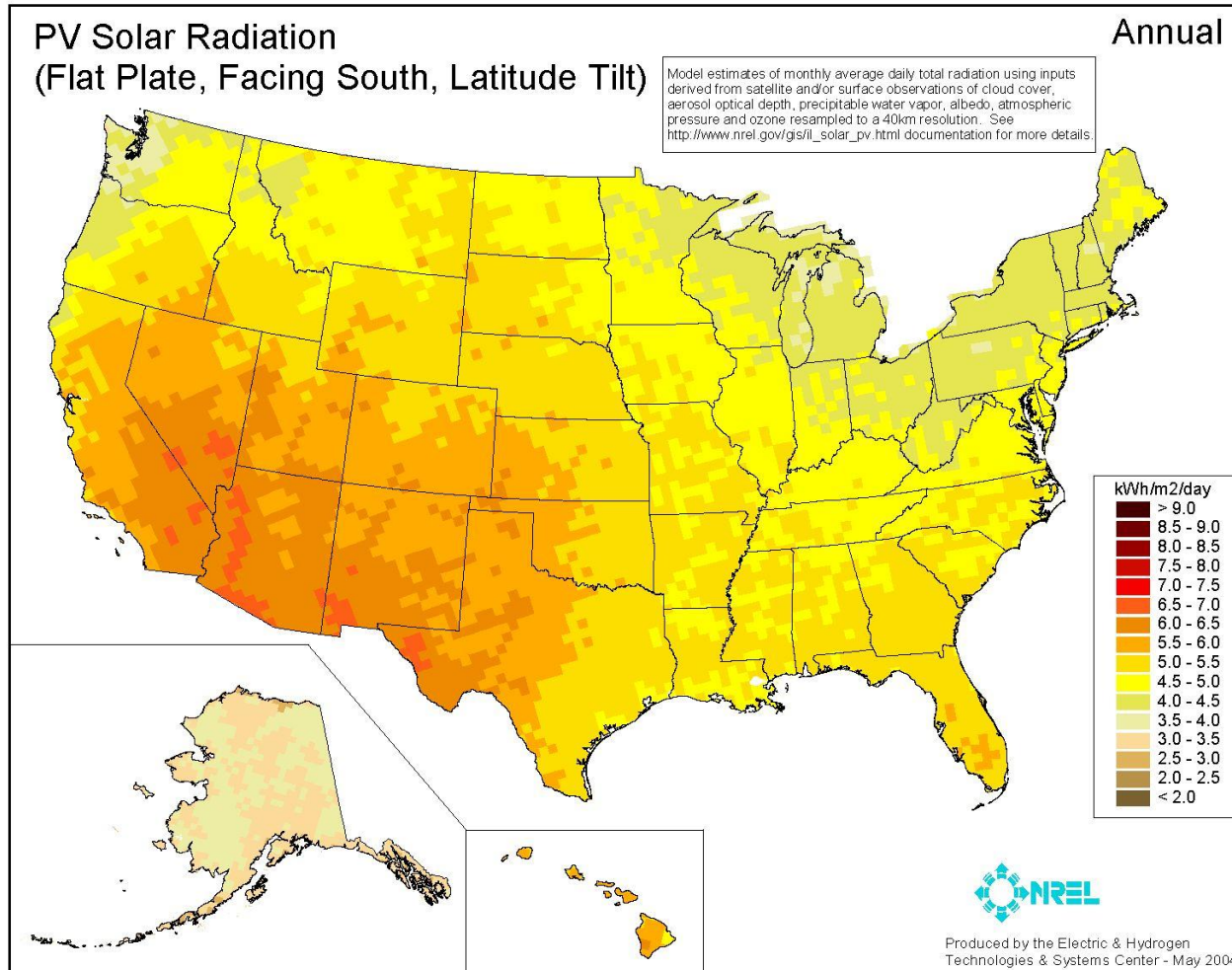
How much sunlight is available to work with?

# Massachusetts Weather

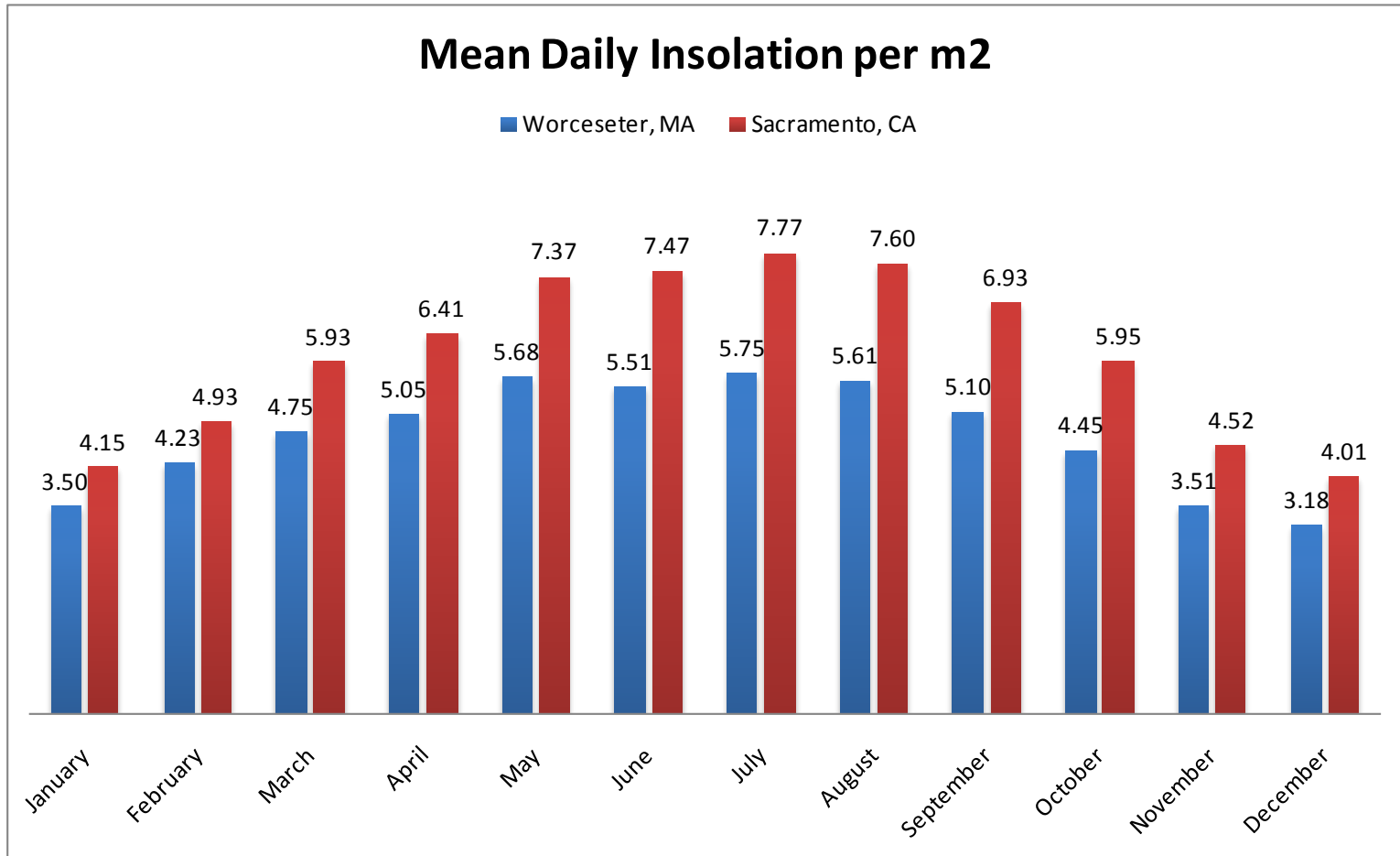
## **Account for the site location:**

- New England Weather is mixed
- Solar panel orientation
  - ▣ South Facing
- Solar panel tilt
  - ▣ 42 degrees

# Solar Insolation



# Worcester's Solar Insolation





# Solar Array Scenarios

What are the affects of a moderately sized array vs. a large array?

# Scenarios

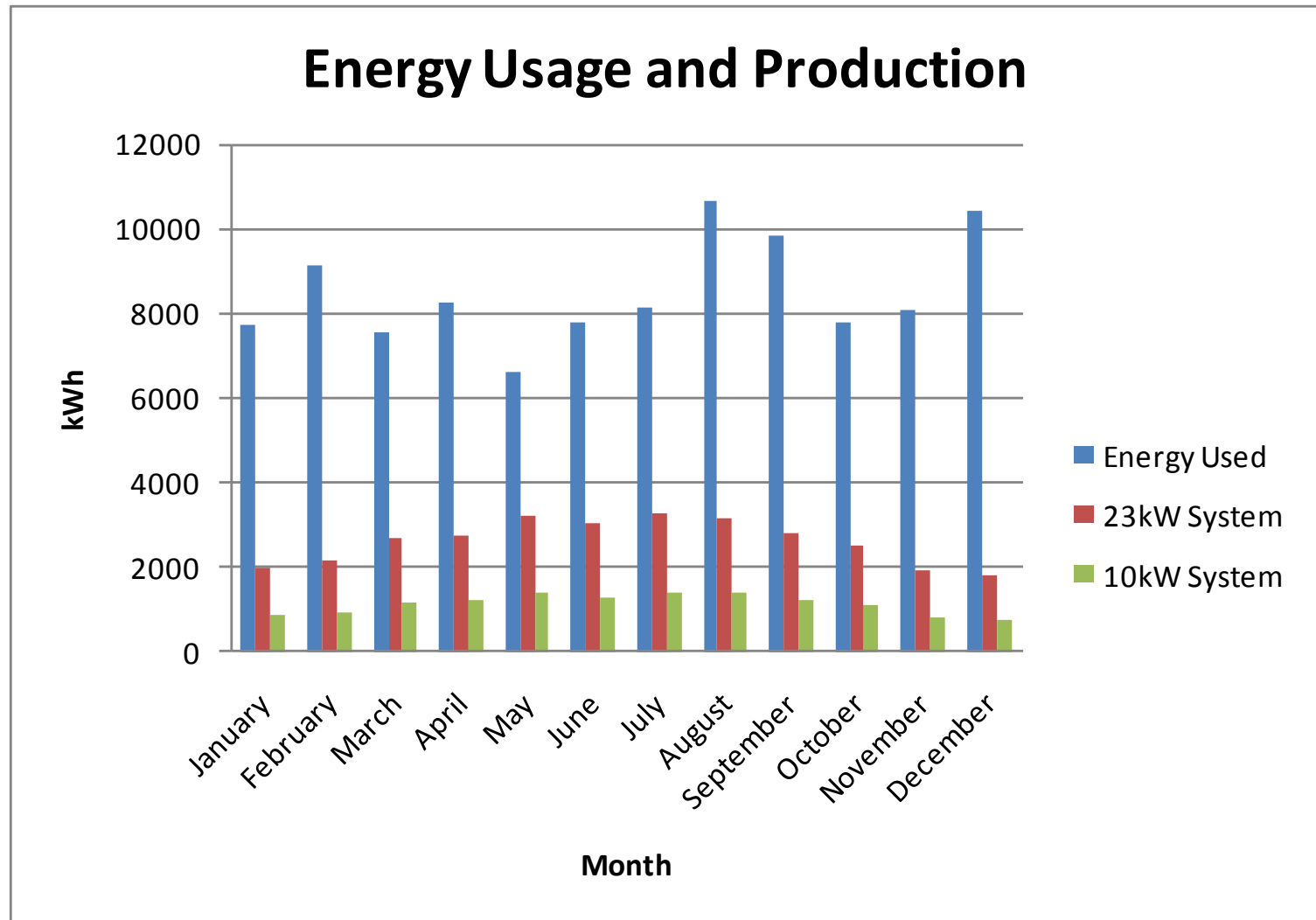
## 10 kW System

- Small capital cost after rebates
  - ▣ \$49,000.00
- 47 Solar panels
- Minimal roof area
  - ▣ 125 m<sup>2</sup>
- 19 years to break even
- \$66,000.00 generated in the array's lifespan
  - ▣ \$15,000.00 total profit

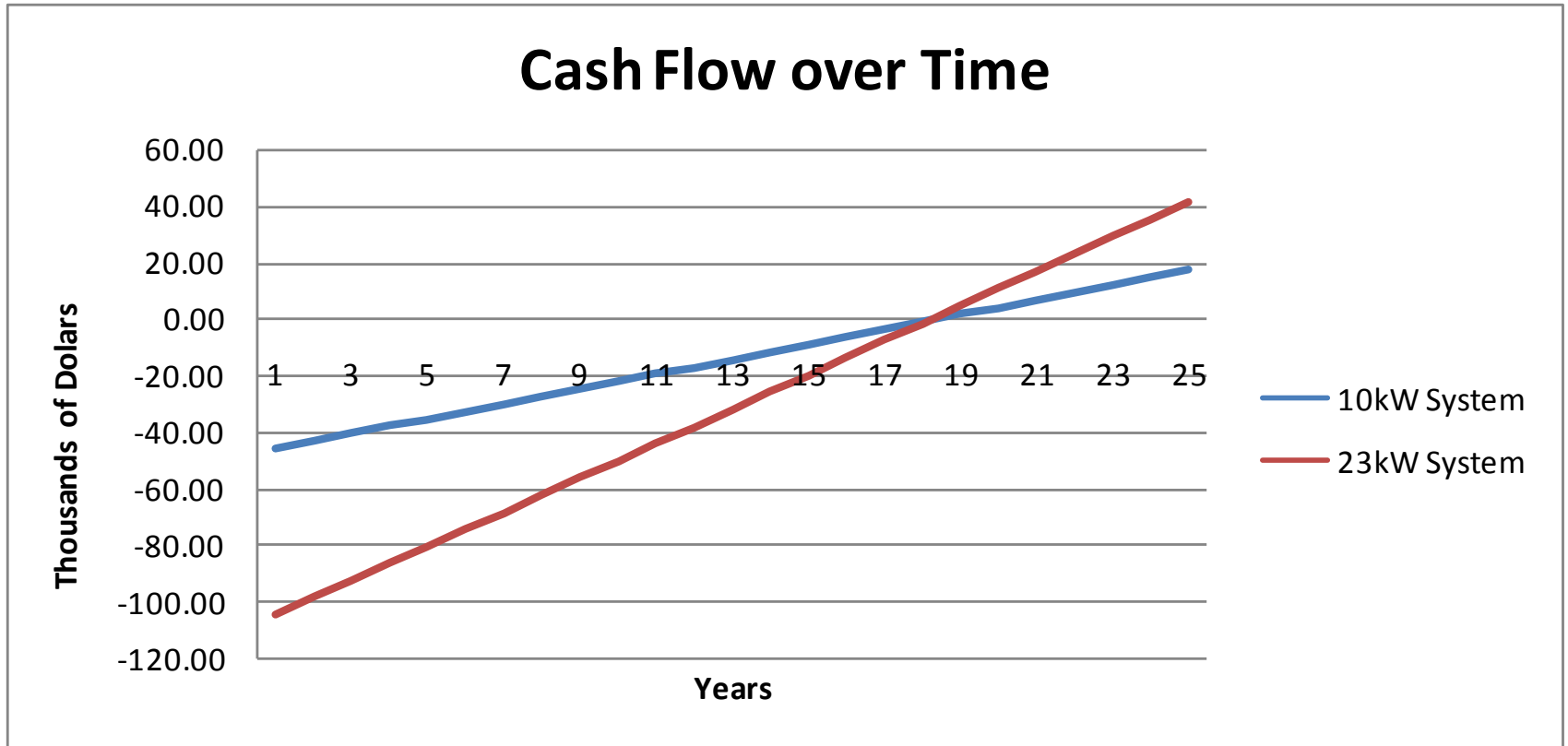
## 23 kW System

- Large capital cost after rebates
  - ▣ \$110,750.00
- 108 Solar panels
- Maximum roof area
  - ▣ 290 m<sup>2</sup>
- 19 years to break even
- \$152,000.00 generated in the array's lifespan
  - ▣ \$41,250.00 total profit

# Energy Production



# System Cash Flow

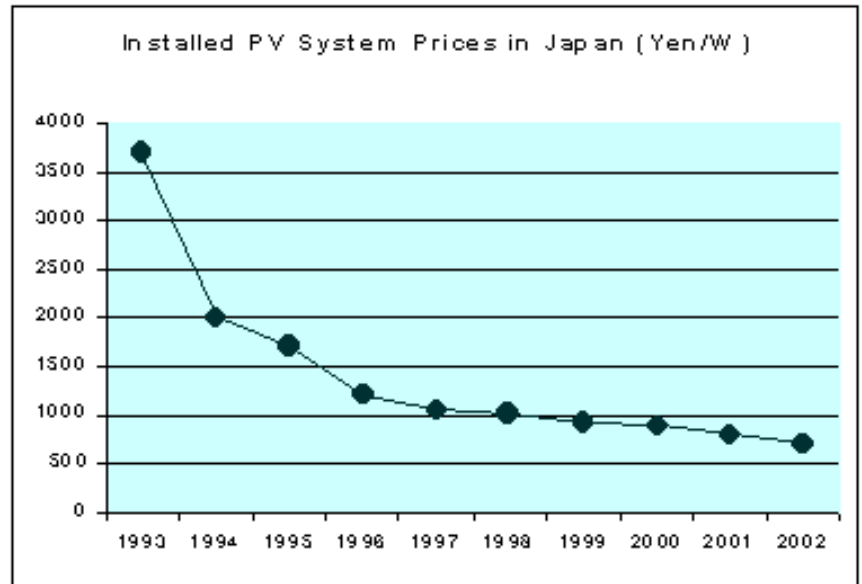


# Future Prices

Will it be cheaper in the future?

# Future Prices

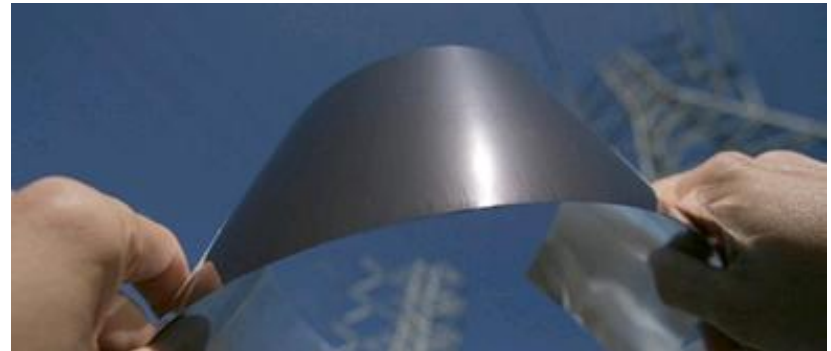
- Earliest technology  
→ \$1800 / Watt.
- Currently  
→ \$5.00 / Watt.
- Future → \$1.00 / Watt?





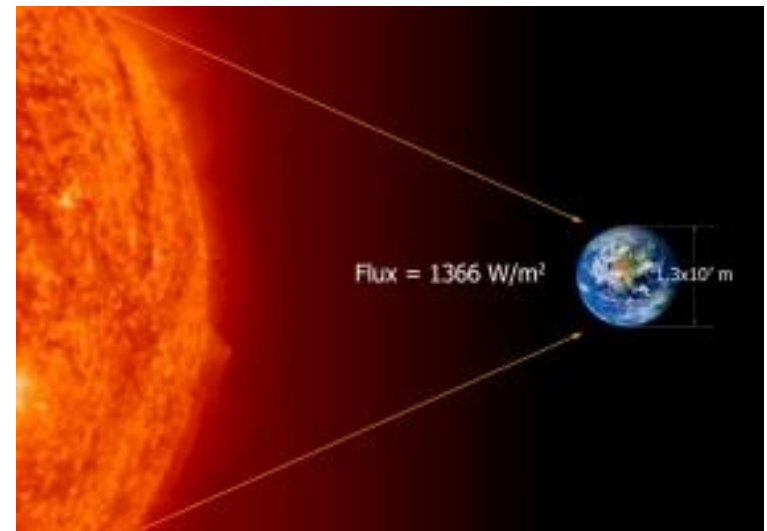


- Boasts of a breakthrough technology.
- Thin film solar panels.
- “Print” semiconductor onto a metal foil.
- Expected to sell \$1.00 / Watt panels soon!



# 1366 Technologies

- Named after the amount of power hitting the earth per  $m^2$ .
- Traditional (multi-crystalline) panels.
- Breakthrough levels of efficiency.
- Expect to sell panels for \$1.00 / Watt by 2012.



# Other Factors

- Demand increases by 50% per year.
- Supply increases by 80% per year.
- Downward pressure on prices.
- Expect prices to fall by 1/3<sup>rd</sup>.



# A future system

What would a system be like if the costs do come down?

# Future Analysis

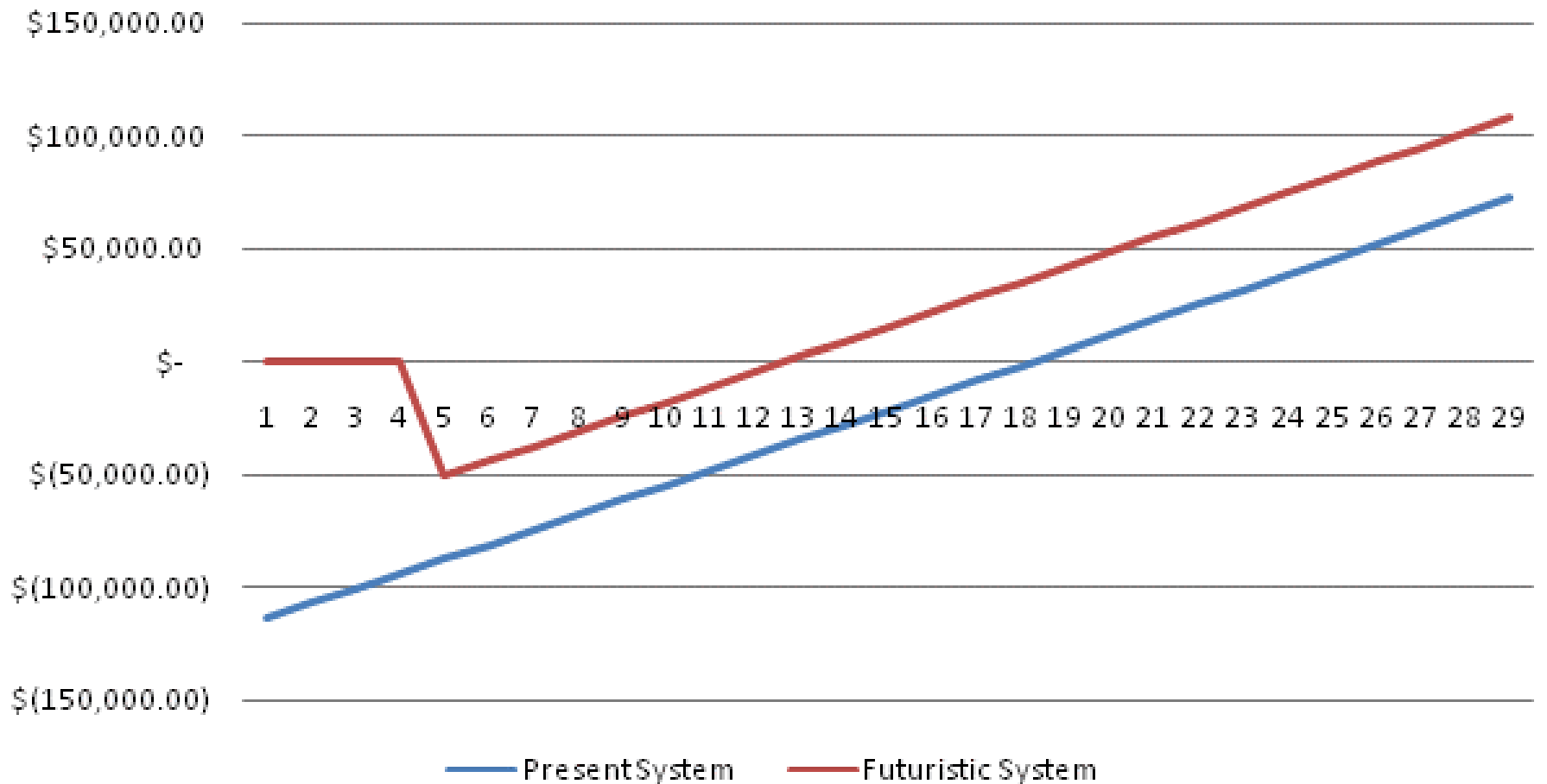
## **If we assume in 5 years:**

- Cost-per-watt of solar cells reduced from \$4.30 to \$2.00
- Solar cell efficiency grows from 15% to 20%

## **Then a 23kW system will:**

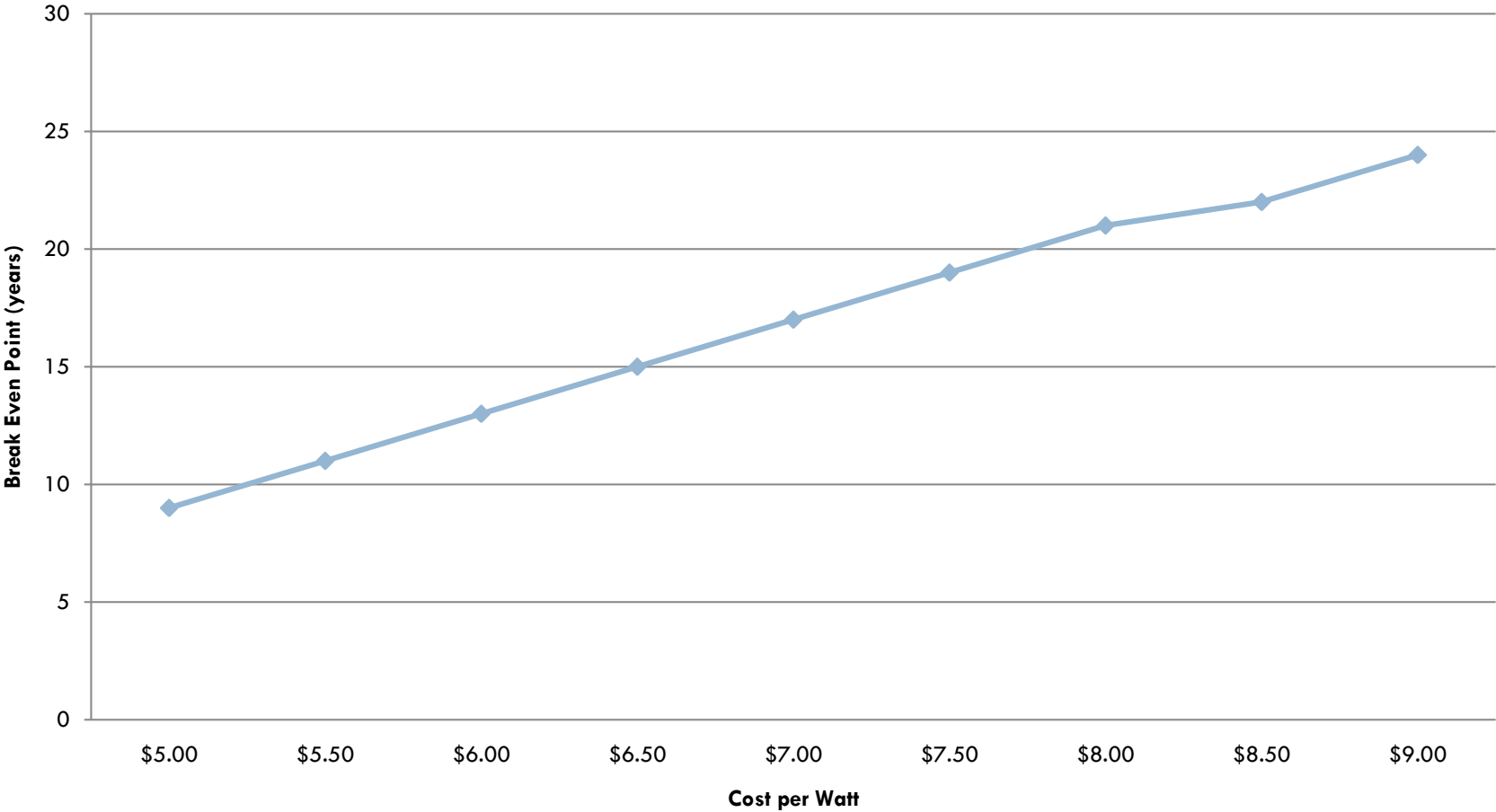
- Require only 81 solar panels (Down from 108)
- Require only 9 years to break-even
  - From right now, it will take 14 years to pay off
  - Waiting 5 years will save 5 years

# Cash flow vs Time



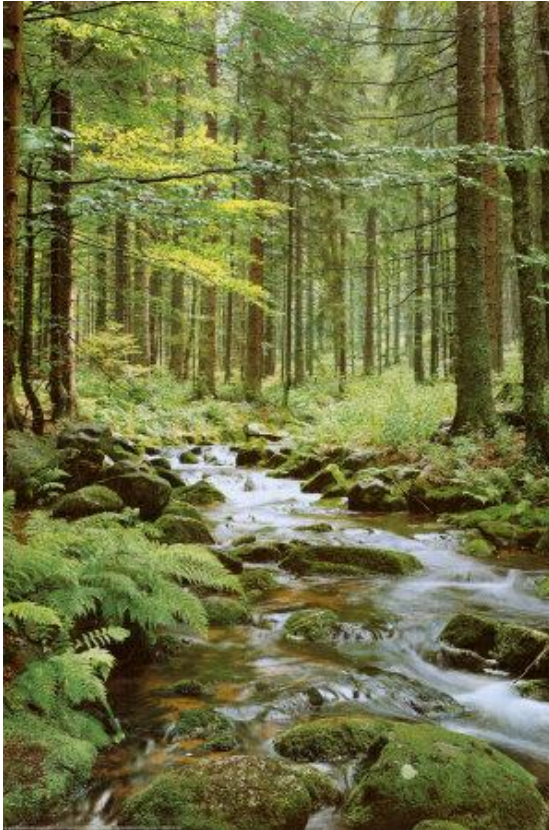


# Payback Versus Cost per Watt



# What would a 20kW system be like?

Planting 1800 trees.



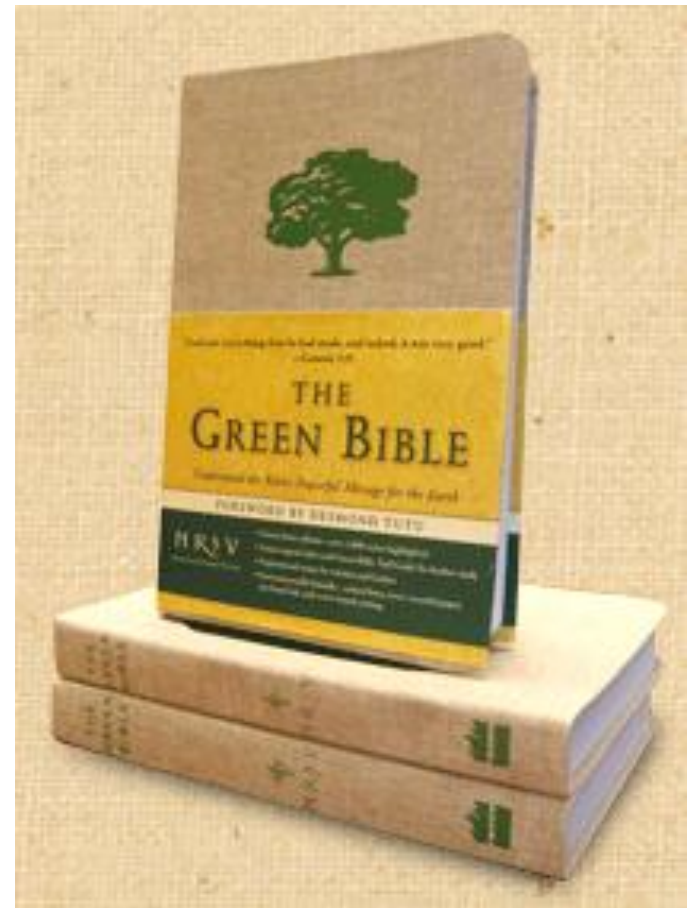
Driving 420,000 less miles.



# Green Stewardship

- Highlights “green” passages.
- A green bible index.
- “The Green Bible sets out an urgent agenda for the Christian community.”

—Eugene H. Peterson, professor emeritus of Spiritual Theology, Regent College



*“You shall not strip  
your vineyard bare, or  
gather the fallen grapes of  
your vineyard; you  
shall leave them for  
the poor and the alien:*

*I am the Lord  
your God.”*

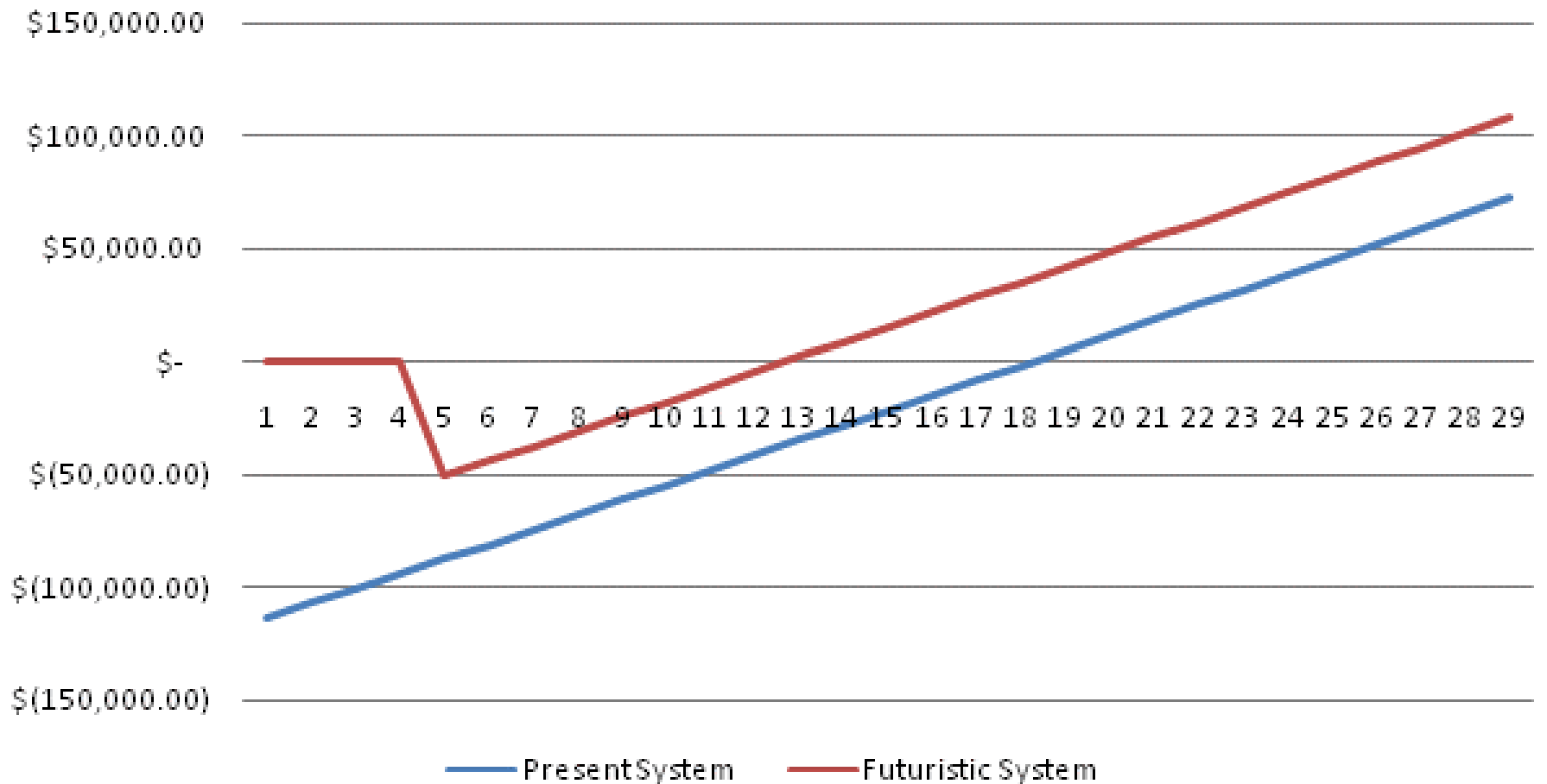
*-Leviticus 19:2*

*“The earth is the  
LORD’s and everything  
in it, the world, and all  
who live in it.”*

*-Psalm 24:1*



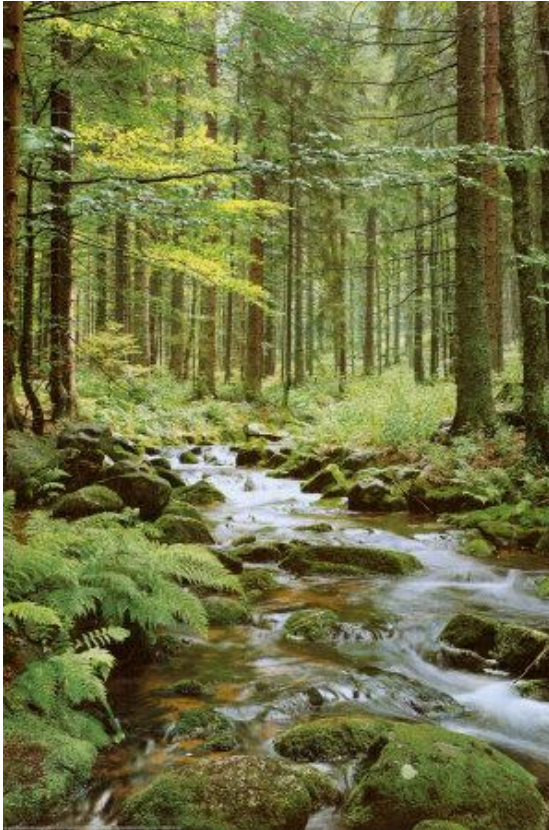
# Cash flow vs Time





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# Final Recommendations

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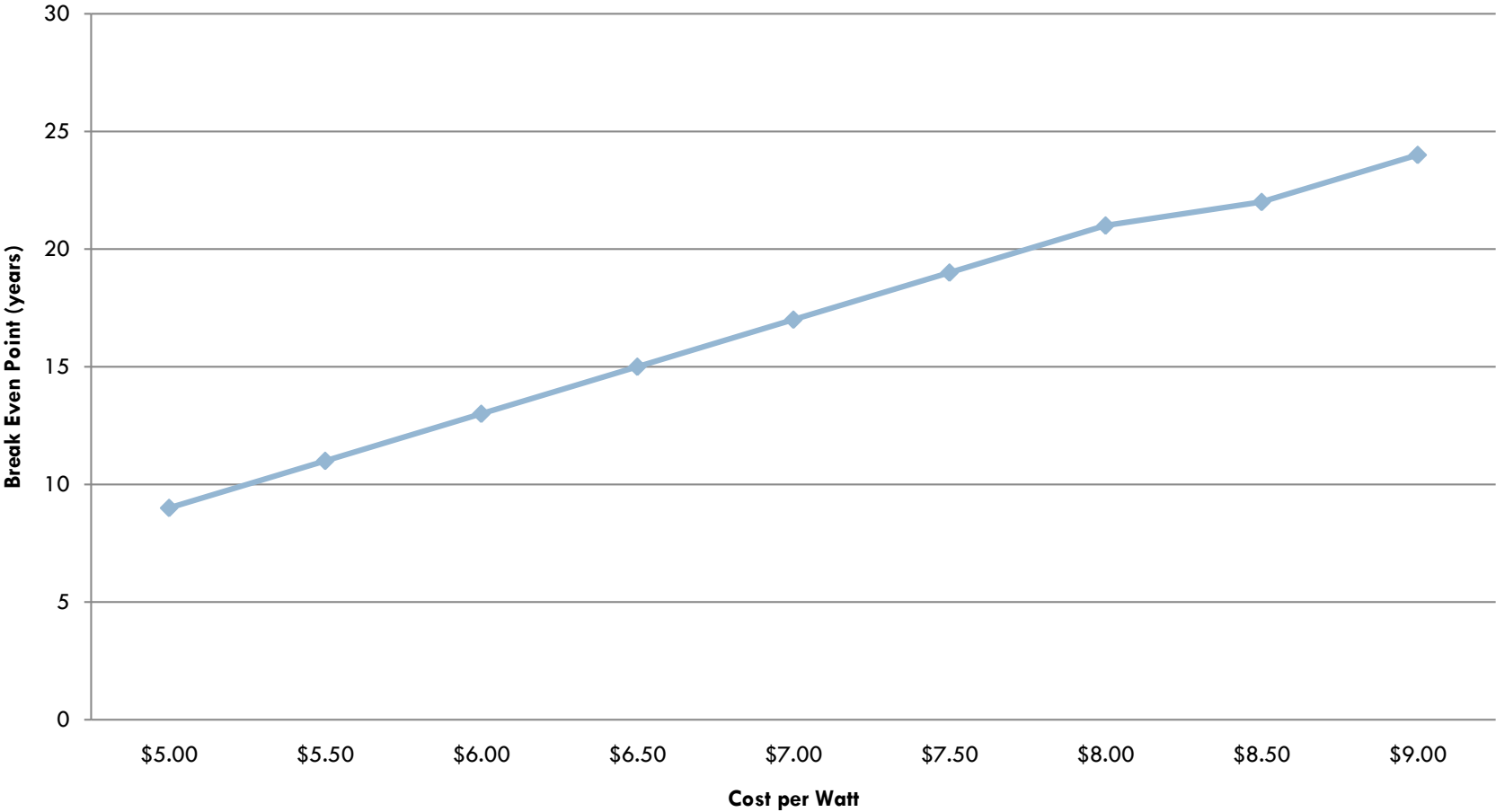
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# Final Recommendations

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2. Get 3 – 5 bids from installers.

# Payback Versus Cost per Watt



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3. Use our tools to project payback period.

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3. Use our tools to project payback period.
4. Choose an installer.

# Final Recommendations

1. Decide whether this should be pursued now or later.
2. Get 3 – 5 bids from installers.
3. Use our tools to project payback period.
4. Choose an installer.
5. Enjoy clean, alternative energy!

# Questions?

