

Grid-Tie Economics

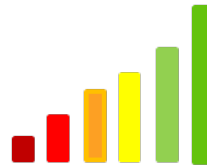
- Net Metering
 - Which Utilities does this apply to
 - Approach for Utilities without Net Metering
- Sizing System
 - One approach is to size to eliminate sell-back to Utility
 - Work through an Example

Grid-Tie Economics – Net Metering

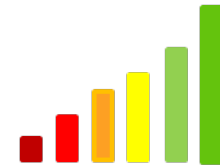
Alternative Energy



Customer

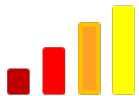


Utility

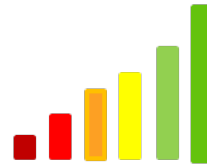


\$ \$

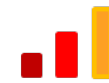
Power Provided
Alternative Energy



Power Consumed
Customer

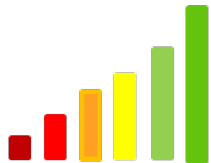


Power Provided
Utility

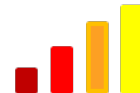


\$

Power Provided
Alternative Energy



Power Consumed
Customer



Power Provided
Utility



Power Provided

Power Consumed

Power Provided

Grid-Tie Economics – Net Metering

- Not all utilities have to purchase power back from their customer. In fact most small utilities in Alaska don't.
- RCA (Regulatory Commission of Alaska) determines which utilities are mandated to abide by Net Metering.
 - Chugach Electric
 - Homer Electric
 - Matanuska Electric
 - Golden Valley Electric
 - Municipal Light & Power
 - Alaska Power Company

Grid-Tie Economics – Net Metering

- It is not the essential that your utility company has net metering, what is more important is that they have an interconnection agreement.
- Interconnection agreement is what allows customers to connect renewable energy systems or even a generator to their residence.
- For an Interconnected system the goal is to design the system to not produce more than the customer is using. This allows the customer to receive the entire amount of the savings from the panel production.

Grid-Tie Economics – System Design

- Design By Maximum Potential- This method is usually determined by the size of the roof or the property. This is less influenced by money and more influenced by total power generated.
- Design By Budget- How much solar can the customer get with the budget they have. Because solar is expandable and modular, almost every budget can be met.
- Design By Energy Savings- This process starts with an electric bill, and a percentage that the customer wants to offset it by.

Grid-Tie Economics – System Design

- Design By Energy Savings Example –
 - Customer with an electric bill that is \$100/month at \$.26/kwh and 384 kwh/month energy usage.
 - The customer wants to offset 50% of their electric bill, or 192 kwh/month.
 - This equates to 6.4 kwh/day. So a system an irradiance of 3.2 solar hours would need a 2.5 KW or roughly 9 solar panels.
 - Check the roof area, cost, and location for shading.
 - DONE!

Economics of Grid-Tie PV System

- Economic Payback is not the only Value
 - Environmental Benefits
 - Self-Reliance
 - Fun Project!
- But, an Economic Payback can Occur!

Available Incentives

- Federal Renewable Energy Tax Credit
 - 30% for Systems in service before 12/31/2019
 - Steps down to 26% for two more years, and then down to 22% for two years.
- *Future Possibility:* Alaska Housing Finance Corporation, Home Energy Rebate Program
 - Funding Ends in March 2016
 - \$4,000 - \$10,000 Rebates were Offered

Install Approaches

- Turnkey – Have contractor do all the work.
- Total DIY – Do everything yourself, except final interconnect.
- Hybrid – DIY Panel Install + contractor for electrical cable from Panels to Utility Meter.

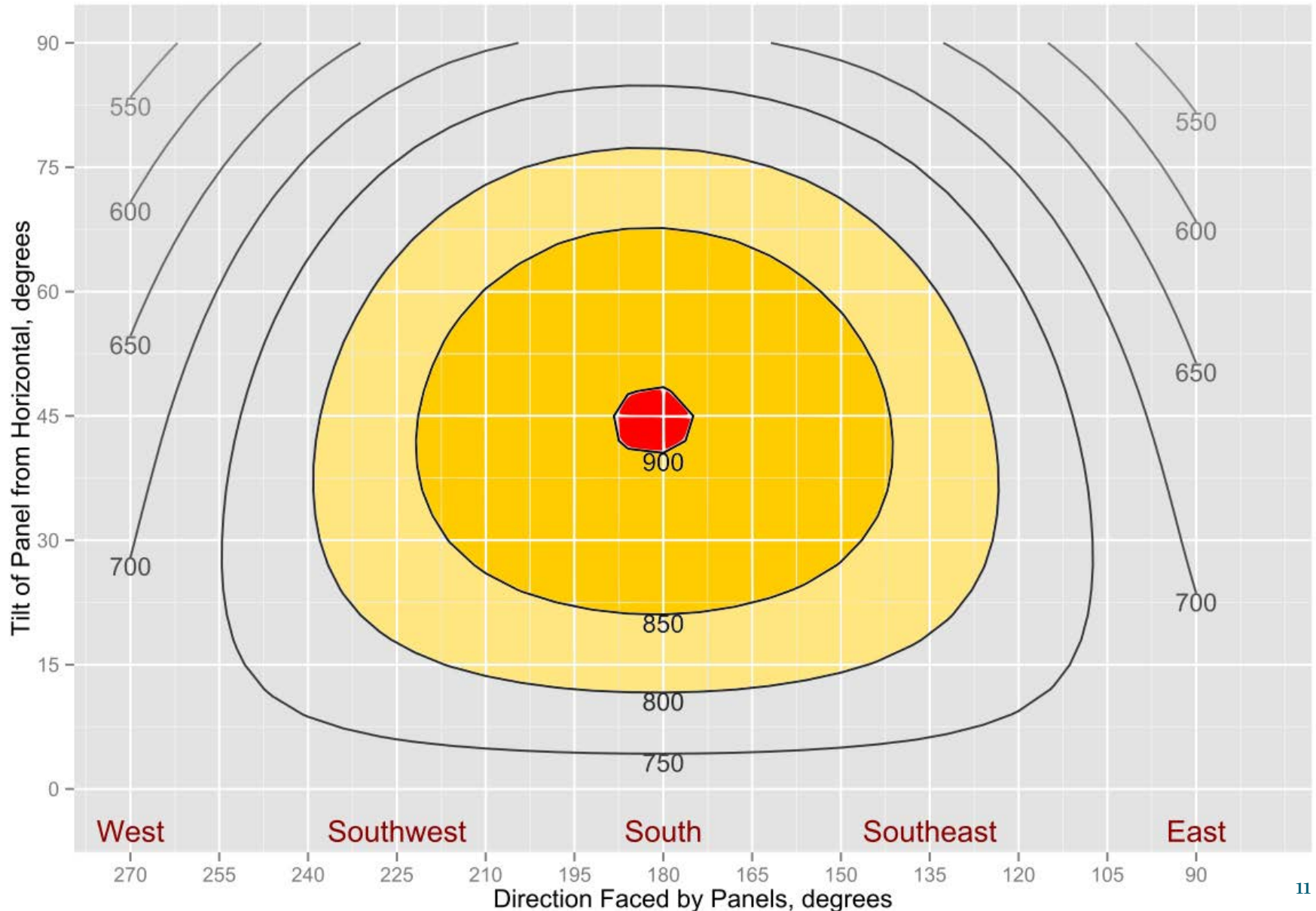
Example Economic Analysis

Turnkey System

Capacity of Solar PV System:	2.85 kilowatts
Annual Energy Production:	2,514 kilowatt-hours per year
This is calculated from 2.85 kW x 900 kWh per kW x (1 - 0.02) additional snow/shading loss	
Installed Cost of System:	\$12,400 Turnkey Cost
Solar Tax Credit:	30%
Starting Electric Rate:	\$0.169 per kilowatt-hour (Chugach Electric)
How fast Electric Rates Increase:	3.0% per year
After-Tax Interest earned on Bank Account:	4.50% per year (Tax-Free Bond Fund)
How Much Solar Output decreases each year:	0.36% per year (monocrystalline cells)
Ignoring Maintenance Costs (self-provided)	

Grid-Tied Solar Output vs Orientation: Anchorage

Annual kWh per kW of Array (3% Shading Loss, 5% Snow Loss)

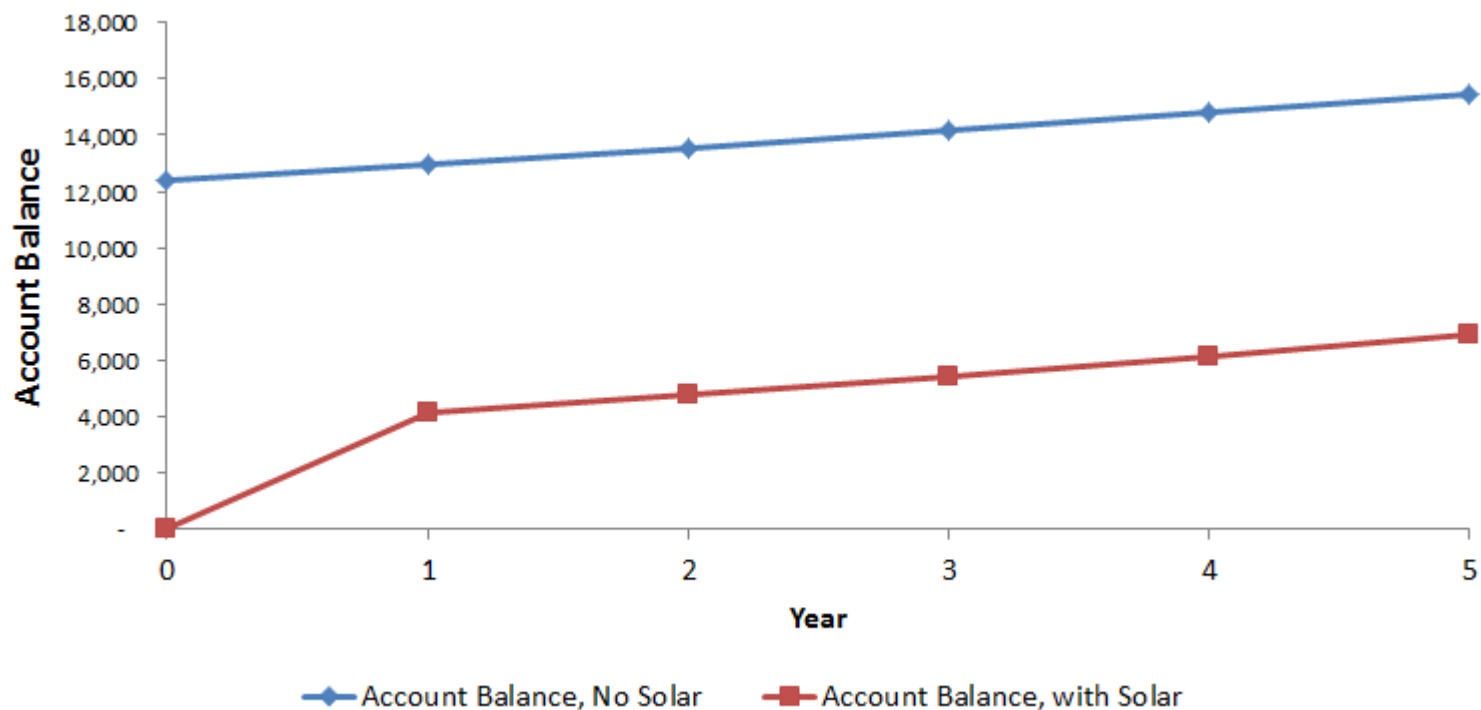


Compare Bank Account with and without Solar

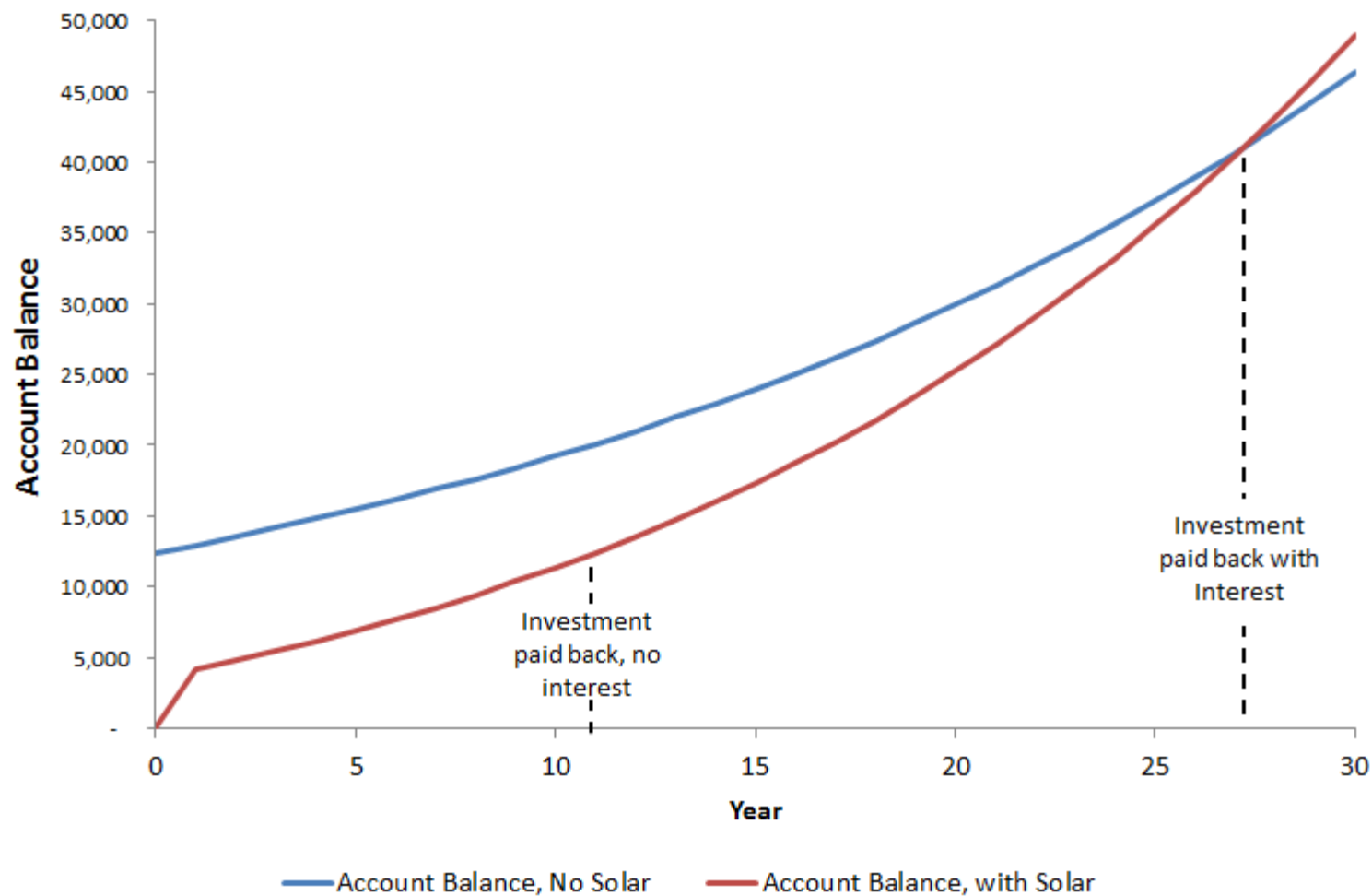
Year	<i>No Solar</i>		<i>With Solar</i>			
	Interest Deposit	Bank Account Balance	Interest Deposit	Energy Savings Deposit	Tax Credit Deposit	Bank Account Balance
0		12,400				-
1	558	12,958	-	426	3,720	4,146

Balance Comparison, continued

Year	Interest Deposit	Bank Account Balance	Interest Deposit	Energy Savings Deposit	Tax Credit Deposit	Bank Account Balance
0		12,400				-
1	558	12,958	-	426	3,720	4,146
2	583	13,541	187	437		4,769
3	609	14,150	215	448		5,432
4	637	14,787	244	460		6,136
5	665	15,453	276	472		6,884



Balance Comparison, continued



Example Economic Analysis

Do-it-Yourself System

Capacity of Solar PV System: **2.85** kilowatts

Annual Energy Production: **2,514** kilowatt-hours per year

This is calculated from 2.85 kW x 900 kWh per kW x (1 - 0.02) additional snow/shading loss

Installed Cost of System: **\$ 6,000** Do-it-Yourself Cost

Solar Tax Credit: **30%**

Starting Electric Rate: **\$0.169** per kilowatt-hour (Chugach Electric)

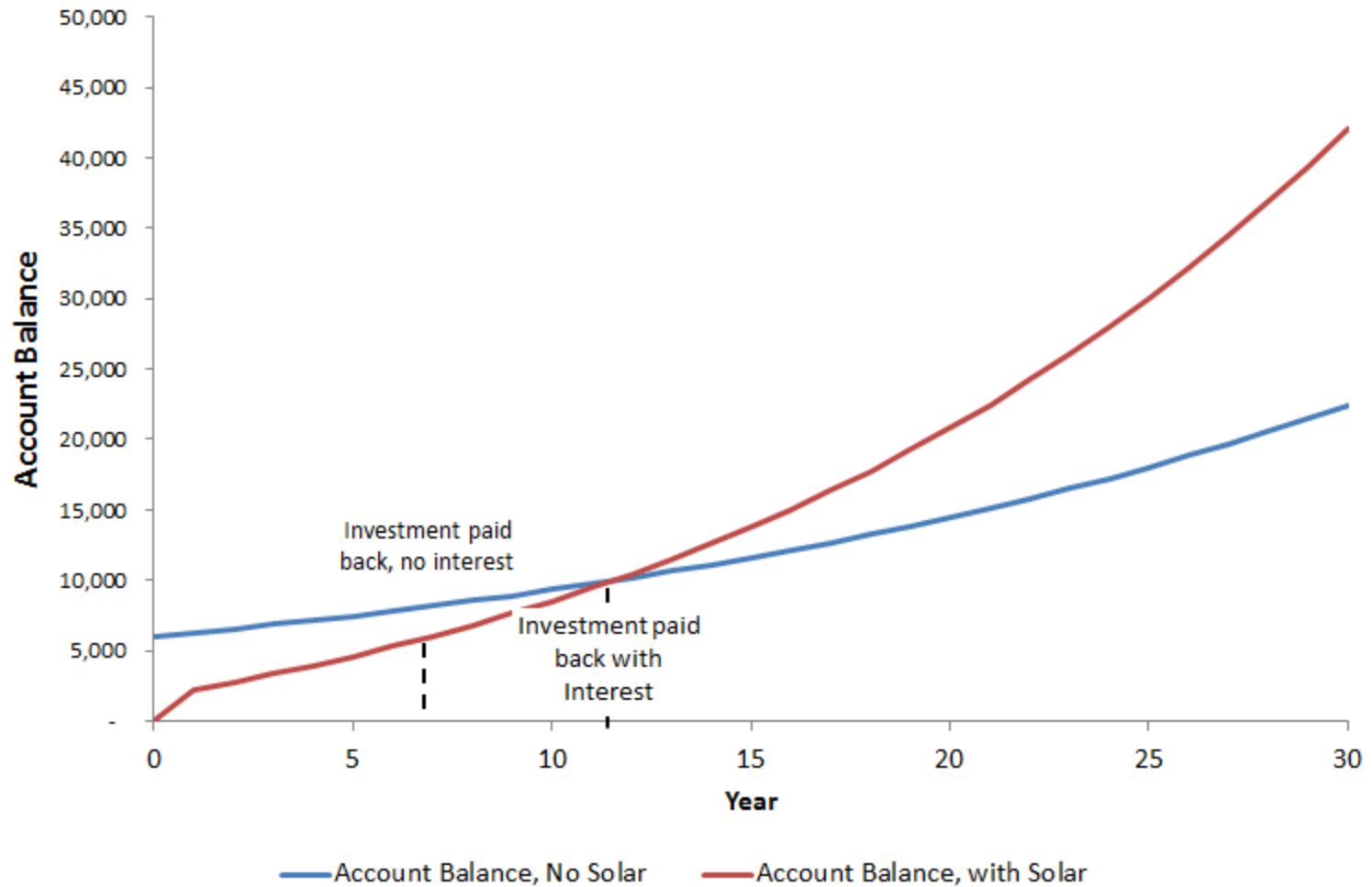
How fast Electric Rates Increase: **3.0%** per year

After-Tax Interest earned on Bank Account: **4.50%** per year (Tax-Free Bond Fund)

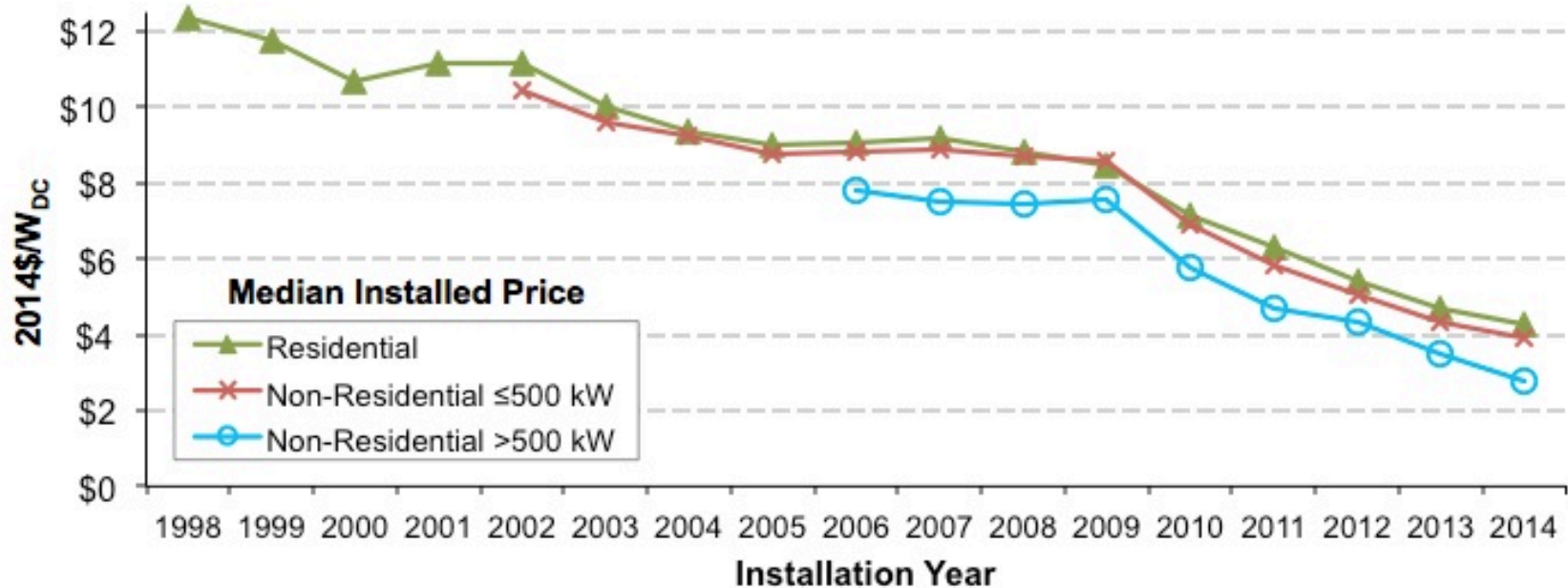
How Much Solar Output decreases each year: **0.36%** per year (monocrystalline cells)

Ignoring Maintenance Costs (self-provided)

Balance Comparison



Solar Costs are Decreasing!



From: Department of Energy's Lawrence Berkeley National Laboratory *Tracking the Sun*, August 2015.

Alaska Grid-Tie PV Systems

- 2.5 kW in the Butte, AK
- 12 kW on the Palmer Wasilla Hwy



25kW - The HUB in Glennallen AK - CVEA grid-tie

• 2.5kW Grid Tie with MEA



- nine 280w SolarWorld panels
- Solar optimizers
- 5 kW SolarEdge Inverter
- IronRidge Mount
- \$6,000 - self install
- - \$1,800 tax credit
- \$1.64 a watt
- 3/30/2015
- 60 deg slope
- Pioneer Peak
- No bill April–Oct.
- 18yr. 5.5% simple ROI
- \$0.19kWh offset
- \$0.07 credit

• 2.5kW Grid Tie with MEA



- nine 280w SolarWorld panels
- Solar optimizers
- 5 kW SolarEdge Inverter
- IronRidge Mount
- \$6,000 - self install
- - \$1,800 tax credit
- \$1.64 a watt
- 3/30/2015
- 60 deg slope
- Pioneer Peak
- No bill April–Oct.
- 18yr. 5.5% simple ROI
- \$0.19kWh offset
- \$0.07 credit

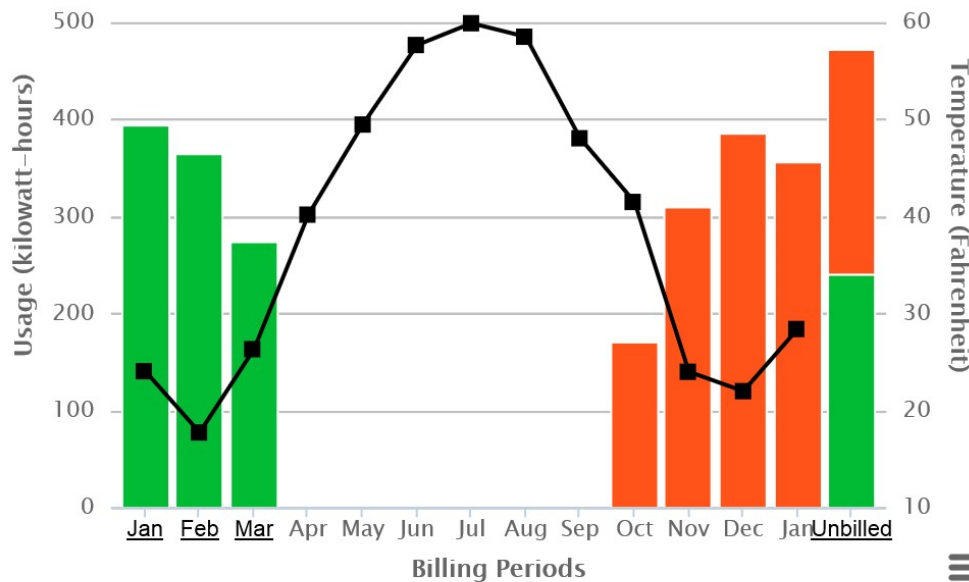
• 2.5kW Grid Tie with MEA



- nine 280w SolarWorld panels
- Solar optimizers
- 5 kW SolarEdge Inverter
- IronRidge Mount
- \$6,000 - self install
- - \$1,800 tax credit
- \$1.64 a watt
- 3/30/2015
- 60 deg slope
- Pioneer Peak
- No bill April–Oct.
- 18yr. 5.5% simple ROI
- \$0.19kWh offset
- \$0.07 credit

• 2.5kW Grid Tie with MEA

- nine 280w SolarWorld panels
- Solar optimizers
- 5 kW SolarEdge Inverter
- IronRidge Mount
- \$6,000 - self install
- - \$1,800 tax credit
- \$1.64 a watt
- 3/30/2015
- 60 deg slope
- Pioneer Peak
- No bill April–Oct.
- 18yr. 5.5% simple ROI
- \$0.19kWh offset
- \$0.07 credit



mea.smarthub.coop/#usage:VVNFUI9JRDpjb2xsaV

The Agate Inn – goal of Net Zero



- 5 highly EE retrofitted buildings
- 12 KW (two 6 kW's)
- Plus solar thermal as district heating

12kW PV - w/solar Thermal, Agate Inn



\$3/W
Self Installed



12kW PV - w/solar Thermal, Agate Inn



- Raking on building - General Specialties, LLC
- Used next to thermal system - UniRac Sunframe
- ABB - Power One – micro inverters
- 48 ea. 250 w Perfer Solar Panels

Grid-Tie Examples - Resources

- [Link to HeatSprings Solar Gant Chart.](#)
- [Link to HeatSprings Solar PV Manual](#)

10 Minute Break



Grid tie off the Alaska HWY 4 in the town of Tok
23kw array at Northern Energy