Energy Northwest Member Forum
Navigating Utility Impacts from Solar Resources

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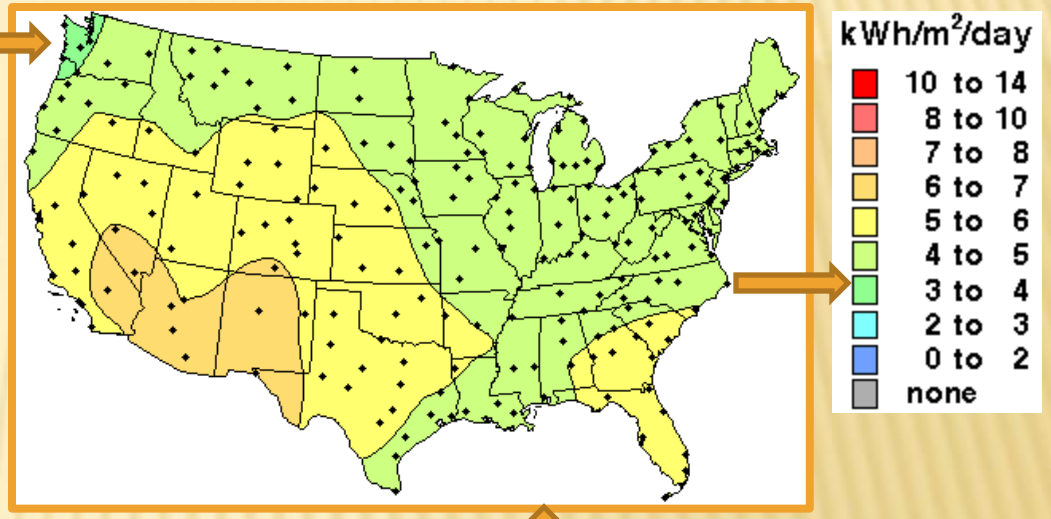
WHY NOW AT BENTON PUD?

- ✓ Washington State
  - ✓ Lowest solar potential per square meter in the U.S.



Source: NREL Resource Assessment Program

- ✓ Benton PUD
  - ✓ 80% renewable hydro
  - ✓ 91% carbon free
- ✓ Washington State
  - ✓ 70% renewable hydro
  - ✓ 77% carbon free

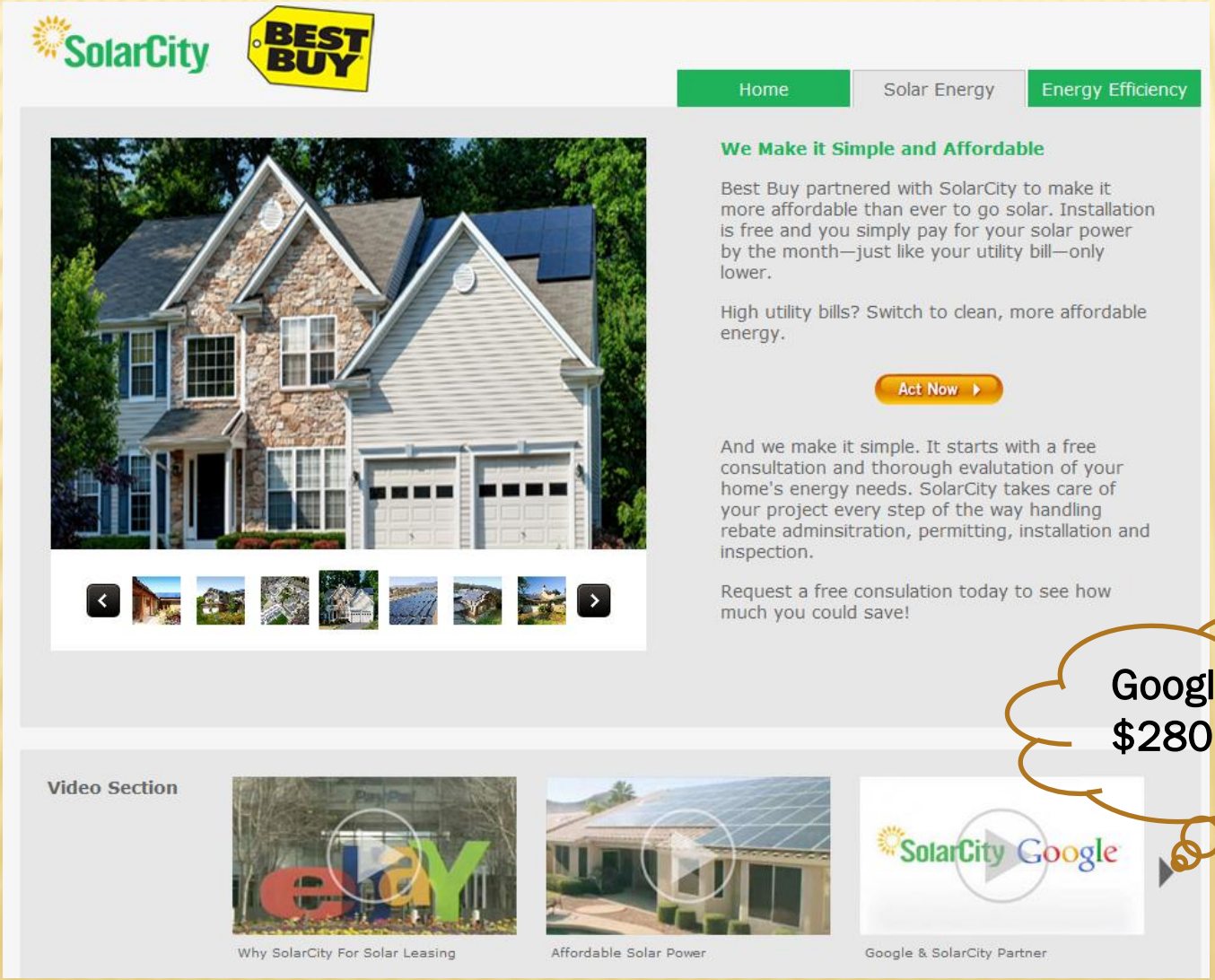
On the surface, numbers are not compelling for our state but business and industry trends are telling a different story.

Source: State of Washington Department of Commerce

LEGISLATORS – ACTING ON ENVIRONMENTAL BELIEFS

ORGANIZATIONS & BUSINESSES RESPOND

BUSINESS INFLUENCES "GOOGLE FACTOR"

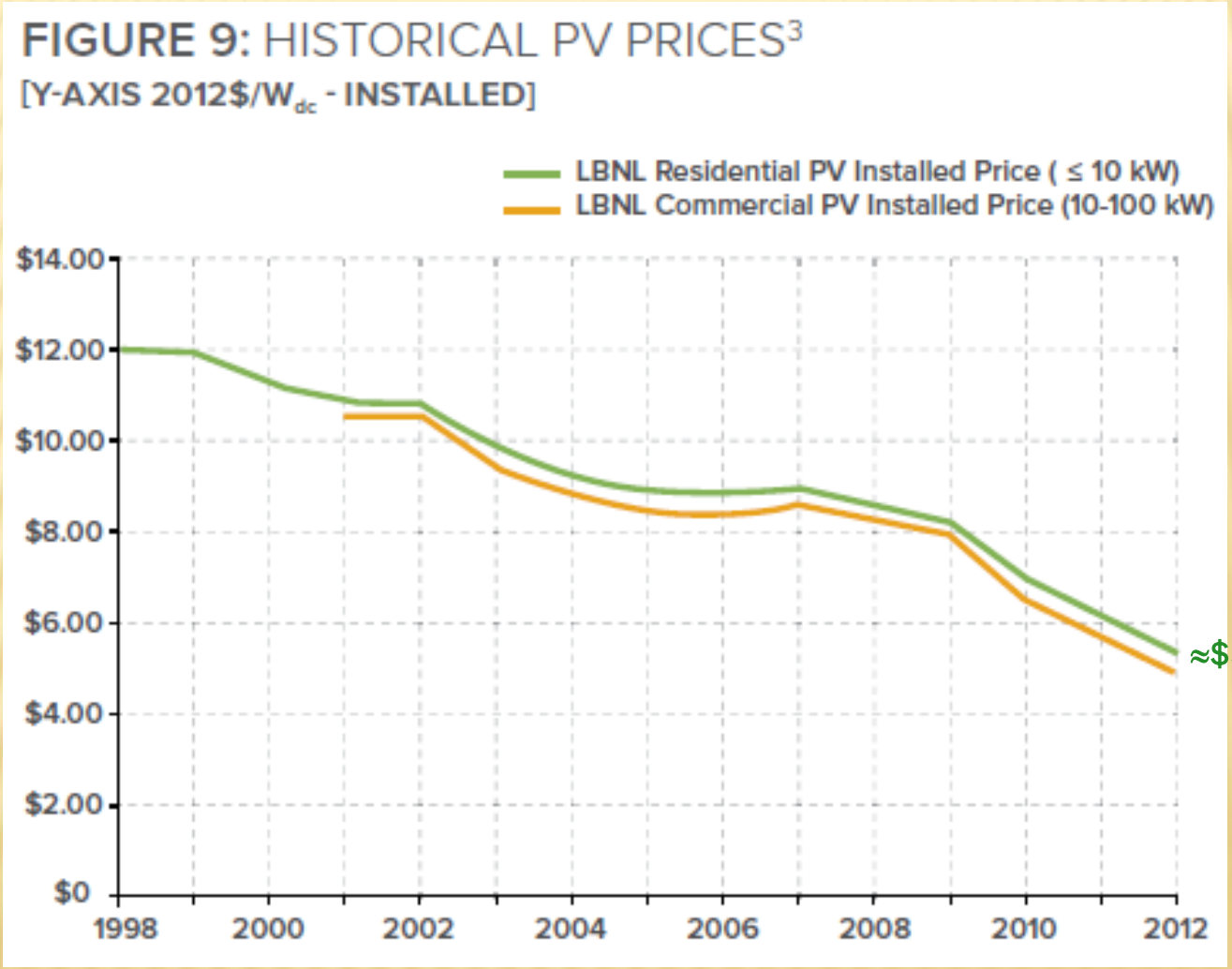


60 Stores

- *Arizona*
- *California*
- *Hawaii*
- *New York*
- *Oregon*

Google invested $280M in SolarCity

SOLAR INSTALLATION COST CURVE



≈$5.50/Watt

Source: Rocky Mountain Institute

LOCAL COMMUNITY INFLUENCES

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Tri-Tech hopes to lure students with solar panel

Bob Brawdy | bbrawdy@tricityherald.com

Shamus Farrell, left, and Mickey Ritthaler, both of Hire Electric Inc. of The Dalles, Ore., install a new solar panel recently at the Tri-Tech Skills Center in Kennewick.

Teachers, staff want to draw students to sustainable building

TY BEAVER
HERALD STAFF WRITER

Milagro Manzanares says she wanted to be an architect when she first began taking classes at Tri-Tech Skills Center.

The Southridge High School senior enrolled in some construction trade courses and began learning about alternative energy and green building practices. She and several other students are designing solar-powered cookers that could help communities in developing countries.

Now Milagro, 17, wants to work as a construction manager or engineer.

"This has opened several doors for me," she said.

Teachers and staff at Tri-Tech, keen to student interest in sustainable building, are hoping to draw more students like Milagro to their program. And they recently got a new tool — a large solar panel on the school's campus in west Kennewick.

The solar panel, paid for by a grant, provides power to the school, but students haven't had the opportunity to work with it yet. School officials hope it will serve as a lure for students as part of a diverse building and engineering curriculum.

Instructor Tony Milewski began incorporating sustainable building into his classes several years ago, he said. Students loved it and he began bringing in new elements each year.

"Everything about it is teamwork and thinking and making their math skills come alive," Milewski said.

Solar power has been a big part of the interest in the class. A group of students last year built a scaled-down home that used solar power to provide electricity and hot water. The project took several honors at the 2013 Imagine Tomorrow competition at Washington State University at Pullman.

This year, along with the solar-powered cookers, another group of students is working on a solar-powered shower for the homeless.

"I never thought I'd be working with solar," said Alexa Castellanos, 16, a Pasco High School junior who came to Tri-Tech interested in home building.

Milewski looked for more ways to augment his courses and was encouraged to apply to the Solar 4R Schools program. Developed by the Bonneville

See STUDENTS | Page B2

STUDENTS | Panel pumping 3 kilowatts of power into school

FROM PAGE B1

Environmental Foundation, the program provides science kits and other materials for teachers and students but also grants for solar arrays.

Tri-Tech chipped in $20,000 and agreed to maintain the solar panel in exchange for the program providing $75,000 for its installation. The array, installed by Hire Electric Inc. of The Dalles, Ore., went online only recently and is currently pumping about 3 kilowatts of power into the school.

The goal is to have the solar panel become the cornerstone of a standalone renewable energy program at Tri-Tech, said Vice Principal Lisa McKinney. Students have enjoyed observing its movements as it tracks the sun and eventually they'll be able to learn how the array is programmed and adjusts to weather conditions.

The device is already turning the heads of visitors and prospective students.

"We just had three days of tours," McKinney said. "Half the kids noticed the thing and the teachers commented on it. It's doing what it's supposed to do."

It could be years or decades before solar power becomes a dominant power source, said Austin Wolley, 17, a Connell High School junior. But he and other students said they're glad to be getting a foothold in the area and that Tri-Tech is working to help the students who come after them.

"We're leading the way to the future," said Jose Anguiano, 17, a Kamiakin High School senior.

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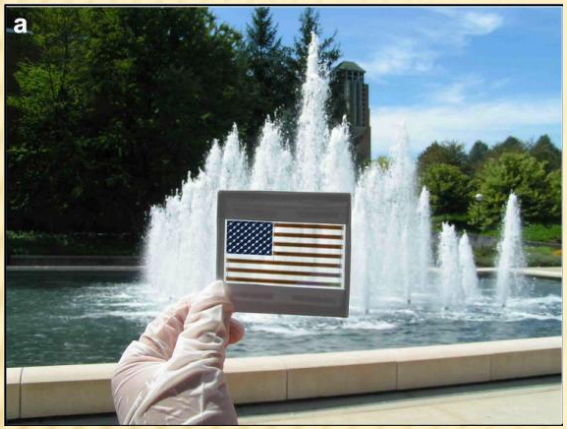
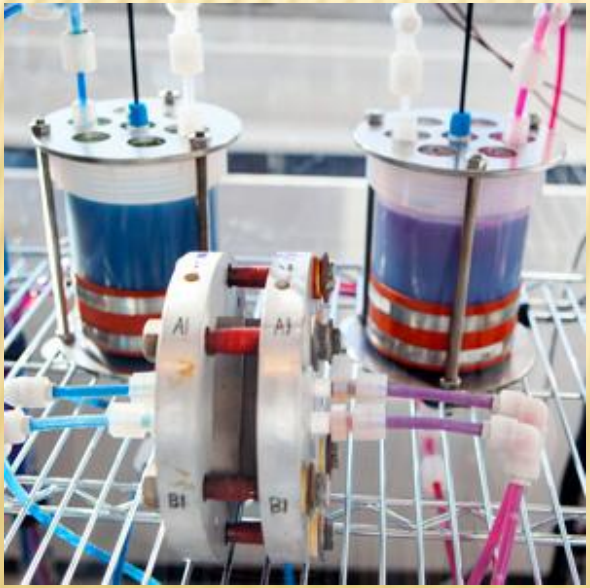
NEW TECHNOLOGY RESEARCH & DEVELOPMENT



UBIQUITOUS SOLAR PANELS?

Colorful, see-through solar cells invented at the University of Michigan could one day be used to make stained-glass windows, decorations and even shades that turn the sun's energy into electricity.



ENERGY STORAGE ADVANCEMENTS

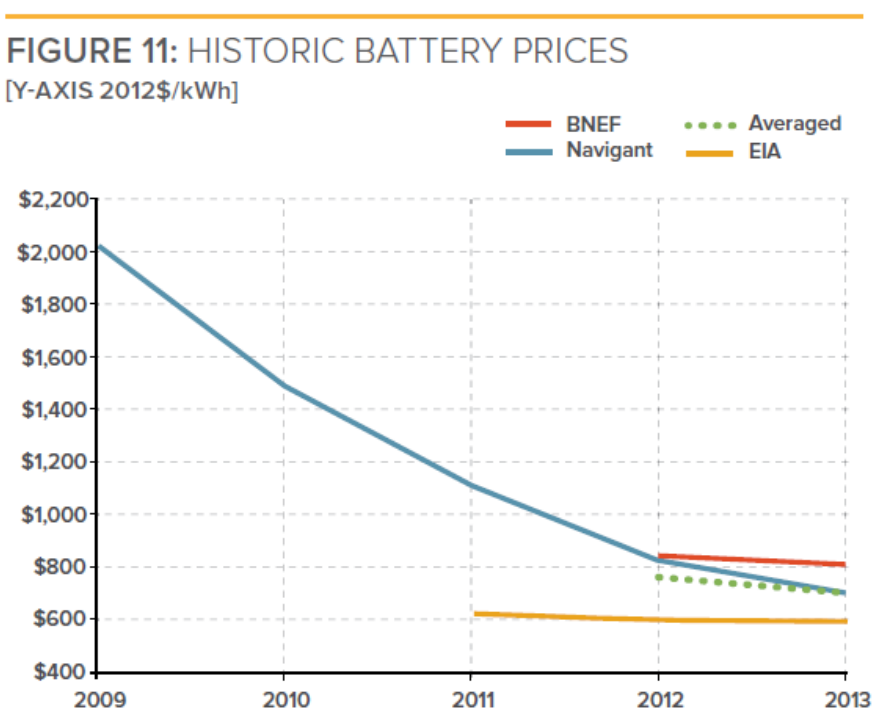
Harvard University researchers say they've developed a new type of battery that could make it economical to store a couple of days of electricity from wind farms and other sources of power.

Battery based on an organic molecule—called a quinone—that's found in plants such as rhubarb and can be cheaply synthesized from crude oil.

*The molecules could reduce, by two-thirds, the cost of energy storage materials in a type of **battery called a flow battery**, which is particularly well suited to storing large amounts of energy.*

Source: MIT Technology Review

SOLAR + ENERGY STORAGE

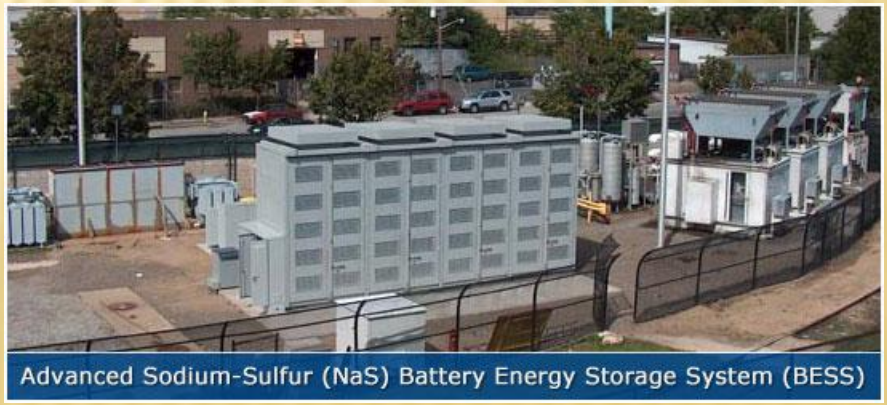


Source: Rocky Mountain Institute

➢ **Electric Vehicle Market**
- Lithium-Ion Technology
- Tesla & Solar City

➢ **FERC Orders 755 & 784**
- Increased pay for "fast" grid frequency regulation (generation & load balance)
- Requires tariffs to include accuracy in addition to capacity

➢ **California AB 2514**
- 1,325 MW energy storage by 2020
- First solicitation by December 1, 2014
- Absolute installation by 2024



Advanced Sodium-Sulfur (NaS) Battery Energy Storage System (BESS)

WHY NOW AT BENTON PUD?

- **Worldwide and national trends toward small-scale more dispersed generation resources** make it apparent we need to begin considering adjustments to our current practices and policies

- **Sustainability** and minimizing your **carbon footprint**
  - ✓ Common objectives for many individuals, particularly the **next generation** of energy consumers
  - ✓ **Solar energy** emerging as the renewable resource with the **strongest sustainability label**

- **Washington state** renewable energy system cost-recovery **incentive payments** are some of the highest in the nation
  - ✓ Platform for customers to develop **energy independence** and/or exercise **environmental beliefs**
  - ✓ Governor Inslee's **executive order** 14-04 appears to support continued incentives

WHY NOW AT BENTON PUD?

- **Facts** surrounding technologies and costs of "clean energy“ **difficult to compile and understand**
  - ✓ Benton PUD is well positioned to connect our customers with the technical and financial resources they may need

- Benton PUD believes it is prudent to begin now to develop the **relationships, processes and capabilities** to efficiently and cost effectively integrate customer generation

- Need to **increase** our **credibility and influence** in shaping state and national energy policies
  - ✓ Requires **actions** we can point to
  - ✓ Move from the “**no side**” of the renewable energy argument where possible
  - ✓ Maintain hallmarks of public utility business model; **community ownership** and **local control**

COMMUNITY OWNERSHIP & LOCAL CONTROL

Community Solar Projects are gaining momentum around the country

COMMUNITY SOLAR - INCENTIVE PAYMENTS

Customer-generated power applicable rates	Base rate (0.30) multiplied by applicable factor, equals incentive payment rate
Solar modules manufactured in Washington **Factor: 2.4** (two and four-tenths)	$0.72
Stirling converter manufactured in Washington **Factor: 2.4** (two and four-tenths)	$0.72
Solar inverter manufactured in Washington **Factor: 1.2** (one and two-tenths)	$0.36
Both solar modules and inverters manufactured in Washington **Factor: (2.4 + 1.2) = 3.6** (three and six tenths)	
Other solar equipment **Factor: 1.0** (one)	$0.30

COMMUNITY SOLAR - WASHINGTON STATE

	Standard	Utility Owned	Company
Max Project Size	75 kW	75 kW	75 kW
Ownership	•Local individuals •Households •Nonprofit organization •Non-utility business	• Voluntarily funded by utility ratepayers	•LLC •Cooperative •Mutual Corp •NOT a "utility"
Property	Local government entity not in the light & power business	Own by Utility or lease from LGE	Local government entity not in the light & power business
Incentive Limits	$5,000 individuals	$5,000 individuals	$5,000 individuals
Tax Incentive Limits 0.5% Taxable Power Sales	Balance of Funds up to $575k	25% of $575k $143,750	5% of $575k $28,750
Practical Limit up to Max Incentive Allowed by Law		94 kW to 341 kW CapX: $470k to $1.7M	19 kW to 68 kW
Environmental Attributes	Belong to participants	Belong to Utility	Belong to participants

COMMUNITY SOLAR - BALANCED INTERESTS

- **Better economics**
  - ✓ Economies of scale vs. rooftop systems
  - ✓ Improved performance vs. rooftop systems
  - ✓ Warranties and performance guarantees
  - ✓ Improved financing options and opportunity to balance interests of developers, customers and utility
  - ✓ Reduced barriers to entry for lower income customers

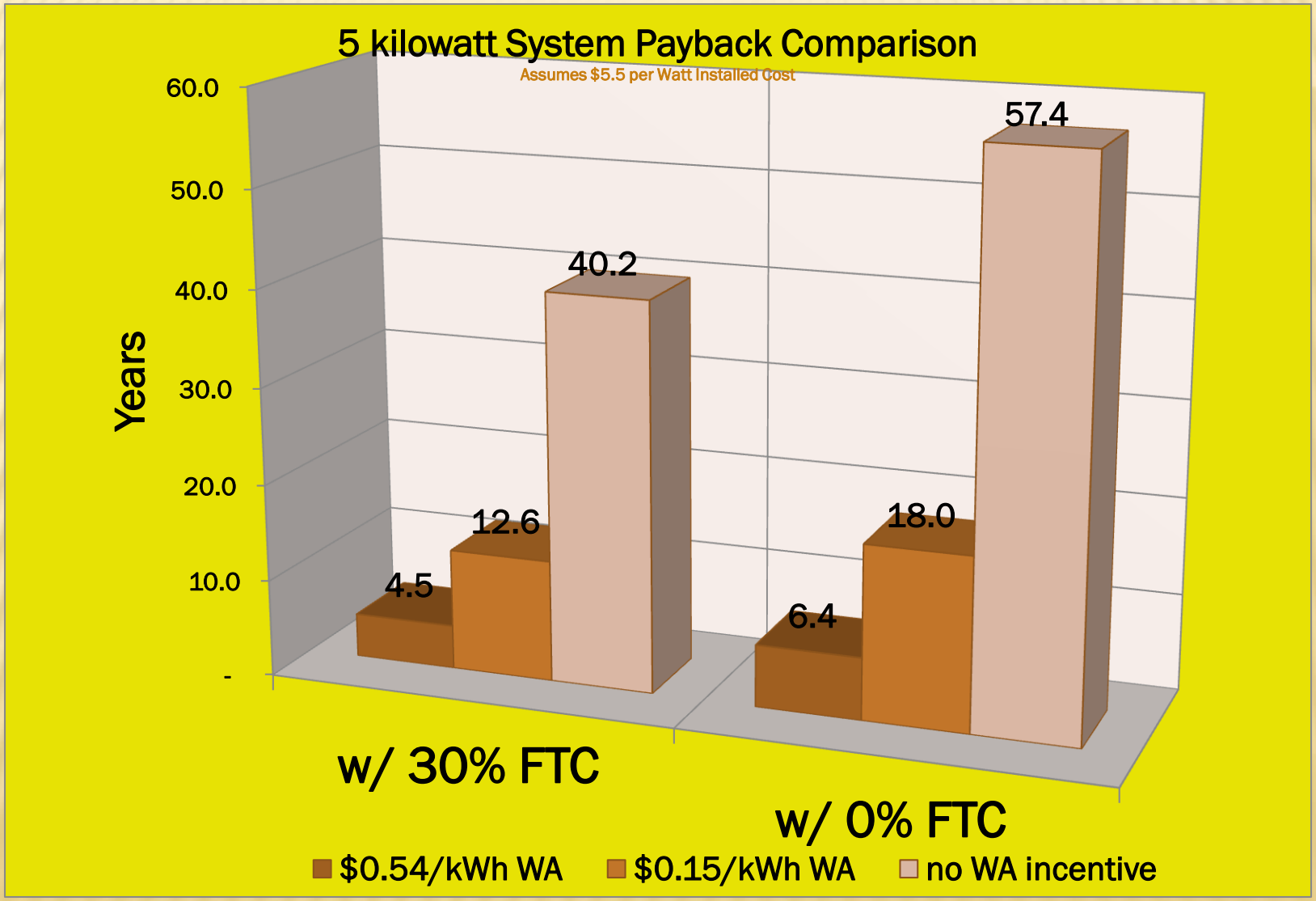
- **Customer role & benefits**
  - ✓ Only 27% of residential rooftop area suitable for solar (NREL)
  - ✓ Customers provide investment dollars on a voluntary basis
  - ✓ Scalable investment customized to customer wants and needs
  - ✓ Maintenance & operation not homeowners responsibility
  - ✓ Investment not tied to current residence; reduced risk and complexity
  - ✓ Reduced barriers to entry for non-technical customers; minimizes possible surprises

- **Utility role and benefits**
  - ✓ Simplified platform for customers who want to exercise their environmental beliefs
  - ✓ Responsive to renewable energy & DG trends while minimizing impacts on non-participants
  - ✓ Increases utility credibility and experience in developing long term power supply solutions
  - ✓ Utility buys the power and may be able to own the RECs
  - ✓ Strategic siting; possibly to the benefit of T&D system operations

INDIVIDUAL CUSTOMER SOLAR - INCENTIVE PAYMENTS

Customer-generated power applicable rates	Base rate (0.15) multiplied by applicable factor, equals incentive payment rate
Solar modules manufactured in Washington **Factor: 2.4** (two and four-tenths)	$0.36
Stirling converter manufactured in Washington **Factor: 2.4** (two and four-tenths)	$0.36
Solar or wind generating equipment with an inverter manufactured in Washington **Factor: 1.2** (one and two-tenths)	$0.18
Both solar modules and inverter manufactured in Washington **Factor: (2.4 + 1.2)** = 3.6 (three and six-tenths)	$0.54
Anaerobic digester or other solar equipment or wind generator equipped with blades manufactured in Washington **Factor: 1.0** (one)	$0.15
Wind generator equipped with both blades and inverter manufactured in Washington **Factor: (1.0 + 1.2)** = 2.2 (two and two-tenths)	$0.33
All other electricity produced by wind **Factor: 0.8** (eight-tenths)	$0.12

INDIVIDUAL CUSTOMER SOLAR - ECONOMICS



NEXT STEPS – SOLAR PROGRAM DEVELOPMENT

- Get **people and organizational structure** in place; who will do what?

- Review how other utilities have done it; better understanding of **best practices**
  - ✓ Benton PUD is a Solar Electric Power Association (**SEPA**) member
  - ✓ SEPA's mission is to support utility integration of solar to the benefit of the utility, its customers and the public good

- Develop written **business plan** for the program
  - ✓ **Staff development** and training requirements
  - ✓ Outreach to **solar installers** and other **potential partners**
  - ✓ **Customer outreach**; near term and long term
  - ✓ Improve existing **net metering** application and contracting **process**

- ✓ Strong focus on **community solar**

- Stay engaged in **legislative process**