Valuing Distributed Solar

Presentation for Solar Stakeholders

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Utility Transformation: On the Road to a New Business Model

- From "Ratepayers" to Empowered Customers
- From dumb 1-way electron flow to 3-way dynamic interactions: utility to customer, customer to utility, customer to customer; facilitated by new market entrants
- From "throughput" model where assets equal wealth and utilities sell a commodity, to an "integrated services" model where the utility creates value for customers and shareholders by delivering services
- From "a requirement to take energy" to manage and self-generate
- From customer control as a threat to distributed energy services as a revenue center

The Core Objective of Value of Solar

- Provide rates and services in the public interest that support:
  - Economic efficiency
  - Societal equity
  - Technological innovation
- Comprehensively assess benefits and costs to the utility, utility customers, and society
- Establish the economic indifference price at which the utility can compensate the customer or make and deliver the service themselves

Beyond Value of Solar

- Value of Storage - Stationary, and soon, the electric vehicle kind (operating in V-to-Grid settings)
- Value of Smarts - smart inverters, home, local grids, substations and feeders
- Value of Security - smart, self-healing, storm-resistant, secure grids and micro grids
- Value of Savings - customer or utility controlled curtail-able and shape-able loads interacting in dynamic curtailment markets

The Ideal Distributed Solar Tariff

- Fair to the utility and non-solar customers
- Fair compensation to the solar customer
- Decouple compensation from incentives
- Align public policy goals (decouple compensation from consumption)
- Intuitively sound and administratively simple

Historical Antecedents

- PURPA (US Public Utility Regulatory Policy Act of 1978)
- Externalities
- Price ≠ Cost
- Green Power
- *Small Is Profitable* (*http://www.smallisprofitable.org/*)
- Local Integrated Resource Planning

Solar Value: Traditional Net Metering

- If solar generation offsets consumption, value is *retail rate*
- If solar generation is excess to consumption, solar value is *retail rate up to consumption, then avoided cost or fuel factor (or average class rate, in MN)*

Issues with Traditional Net Metering

- PURPA legacy
- Relationship between retail rates and solar value
- Accounting under-recovery for the utility, impacts between rate cases
- Low payments for solar offset & excess energy
  - Reduces optimal investment size
  - Encourages consumption during periods of solar production
- Monthly true-up leads to sub-optimal system size; sub-optimal investment per install
- Perverse results with tiered rates

Solar Value: Analytical Approach

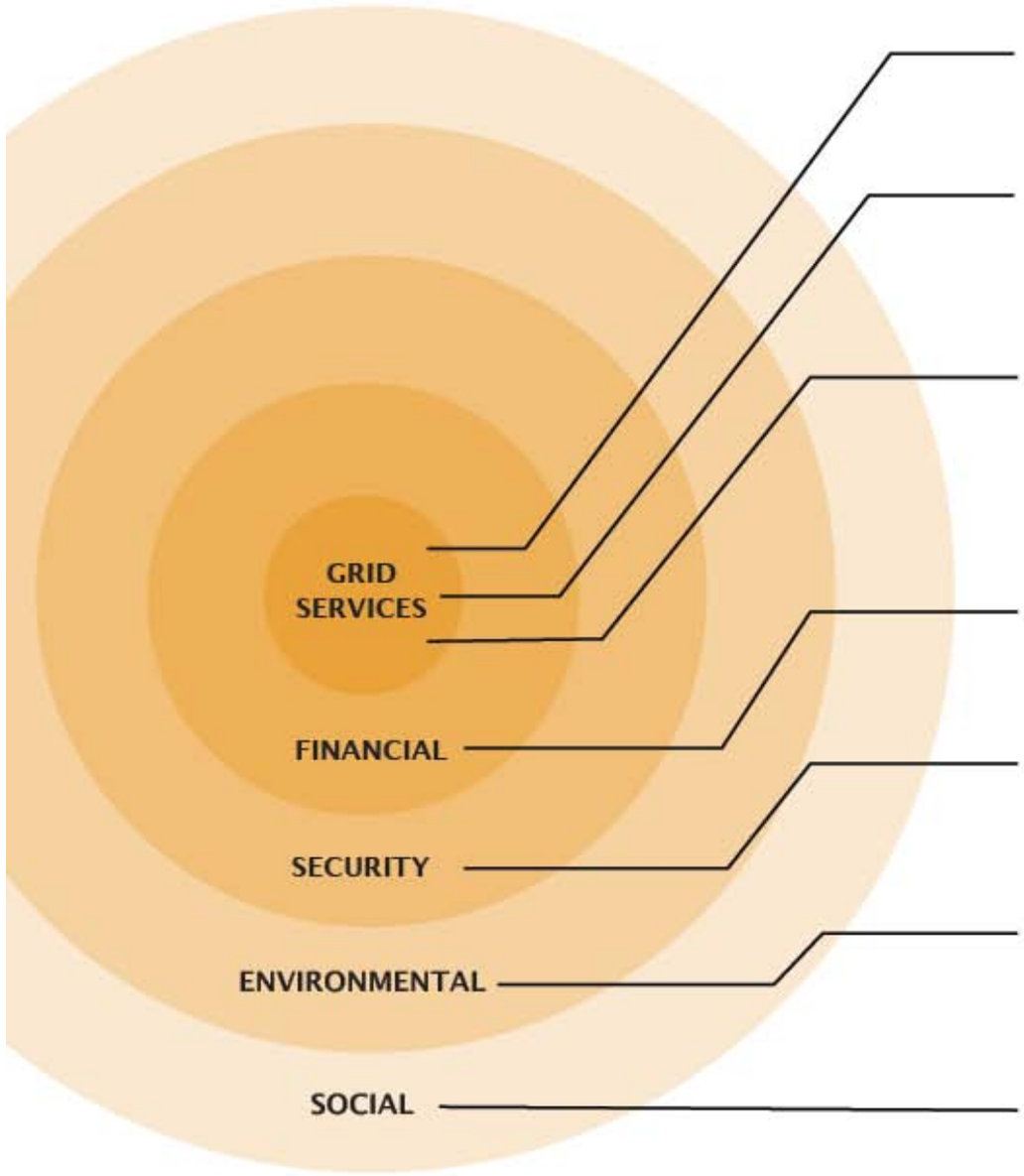
- When a customer and the community invest in solar, it provides valuable, privately-funded, clean electricity at or very near the point of use.
- If the utility had to provide that same electricity, what would it be worth?
  What is the fair value?
- Analysis shows value or avoided expenses for:
  - Electric energy
  - Electric capacity
  - Transmission (energy & capacity)
  - Distribution (energy & capacity)
  - Line losses (transmission & distribution)
  - Fuel price hedging (cost to maintain stable fuel prices)
  - Environmental value (non-fossil, carbon-free, "waterproof")
- Analysis shows additional societal value, often >2X utility value, for jobs, economic development, local tax revenues, etc.

Solar Value: Analysis-Based

BENEFIT & COST CATEGORIES

Lab
Electricity Innovation Lab
ROCKY MOUNTAIN INSTITUTE

For the purposes of this report, **value is defined as net value, i.e. benefits minus costs.** Depending upon the size of the benefit and the size of the cost, value can be positive or negative. A variety of categories of benefits or costs of DPV have been considered or acknowledged in evaluating the value of DPV. Broadly, these categories are:



ENERGY
- energy
- energy losses

CAPACITY
- generation capacity
- transmission & distribution capacity
- DPV installed capacity

GRID SUPPORT SERVICES
- reactive supply & voltage control
- regulation & frequency response
- energy & generator imbalance
- synchronized & supplemental operating reserves
- scheduling, forecasting, and system control & dispatch

FINANCIAL RISK
- fuel price hedge
- market price response

SECURITY RISK
- reliability & resilience

ENVIRONMENTAL
- carbon emissions
- criteria air pollutants (SOx, NOx, PM10)
- water
- land

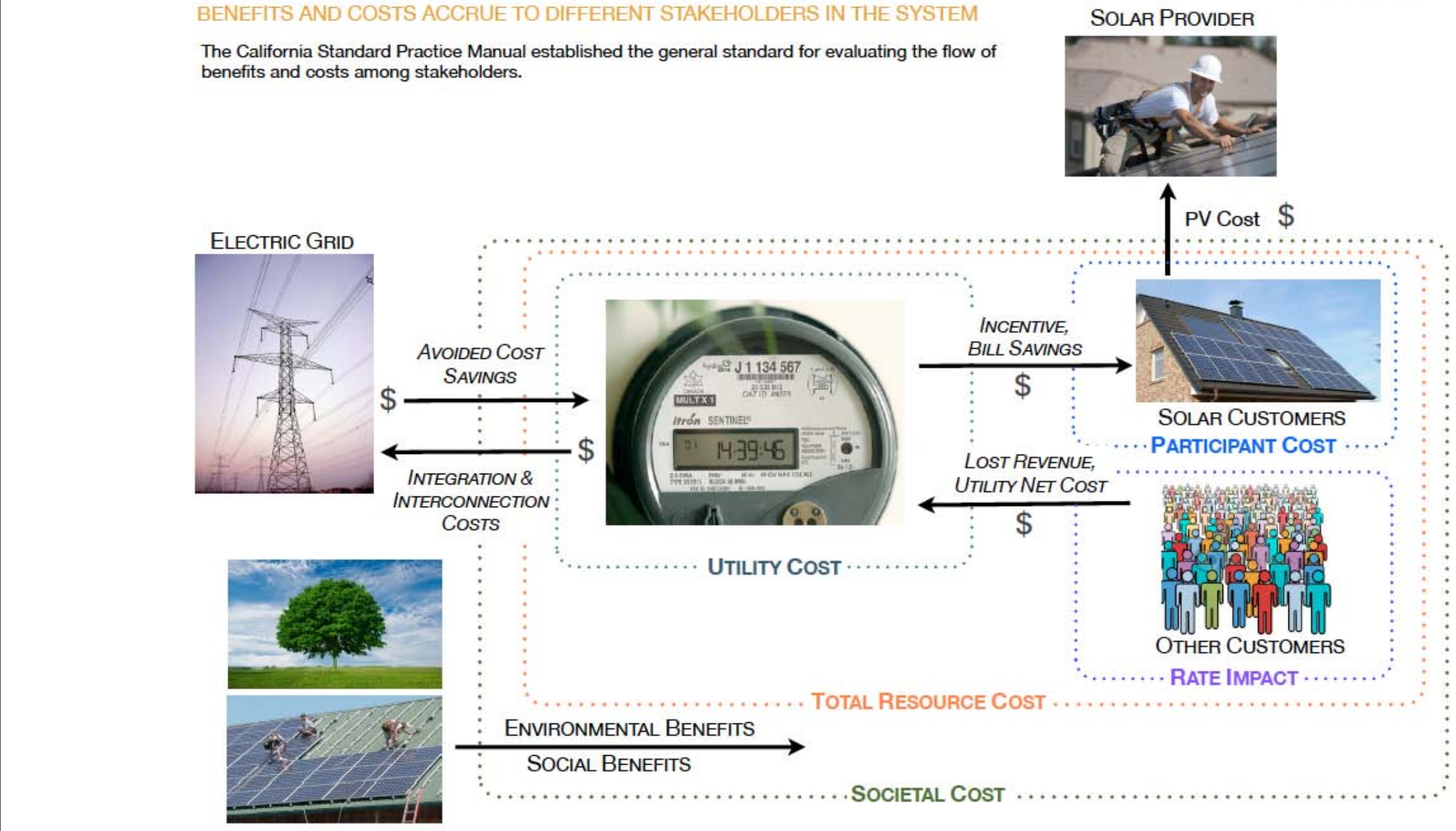
SOCIAL
- Economic development (jobs and tax revenues)

Solar Value: Analysis-Based

FLOW OF BENEFITS AND COSTS

BENEFITS AND COSTS ACCRUE TO DIFFERENT STAKEHOLDERS IN THE SYSTEM

The California Standard Practice Manual established the general standard for evaluating the flow of benefits and costs among stakeholders.



Two Simple Changes

- Compensation - Change from:
  - “retail up to consumption, then something else" (avoided cost/fuel, avg. retail, etc.)” to
  - “annually updated value of solar (present value of 30-year stream) for ALL solar generation
- Rate Design- Calculate bill by charging for total consumption as if the customer had no solar, then credit ALL solar production at the value of solar rate (other options possible)

Billing the Value of Solar Rate

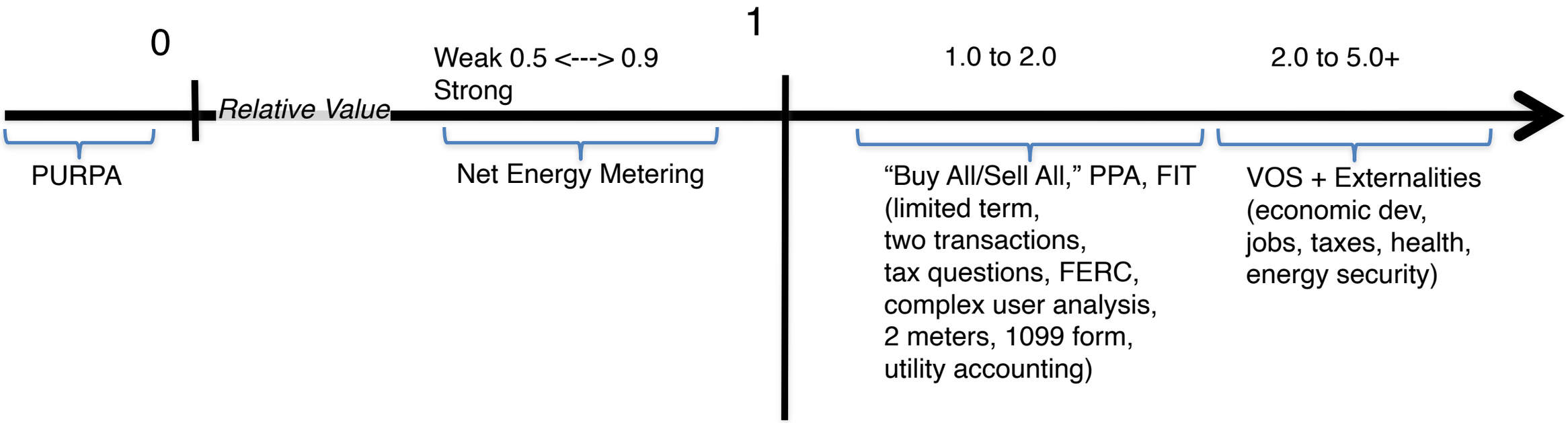
Customer Charge (per customer)	$
Energy Charge (per total kWh use)	$
Fuel Charge (per total kWh use)	$
Other Charges	$
Total Charges	$
Value of Solar Credit (per solar kWh)	($)
Total (net) Bill	$

- The solar customer is charged for all energy consumption as if the customer did not have a solar system. This ensures that utility cost of service is always covered, regardless of solar system performance.
- The solar customer is credited for all solar generation at the annually adjusted VOS rate, empirically derived, based on actual values.
- The customer pays any net charges, carries over net credits to the next month, for 1 year.
- All credits remaining at the end of the year are zeroed out. (tax issue)
- The utility accounts for the difference between the charges and the credits through the fuel factor.

Major Benefits of VOS Approach

- Reduces or eliminates class subsidies
- Explicitly charges for consumption; keeps utility whole on cost of service (some utility upside due to conservative calculation approach)
- Incentive for efficiency
- Annual adjustment prevents over- or under-payment as utility costs change
- Better aligns with sound rate making principles
- Reduces simple payback; reduces pressure on incentives

Distributed Solar Value Continuum



Value of Solar Rate

(annually adjusted, present value of 30-yr stream,
net on 1 bill, 2 meters, avoids cross-subsidy,
recovers cost of service, encourages efficiency)

Cautions When Reviewing Studies

- Why, when was the study conducted?
- Who conducted the study, and for whom?
- Were results annualized or levelized?
- What system assumptions for the study?
- What level of solar penetration was studied?
- What stakeholder perspective was assessed?
- What granularity applied to the study?
- What models were used within the study?

Suggested Step-Wise Approach

1. Undertake Value of Solar Analysis
    - Index & improve net metering rate
    - Evaluate PPA offers
    - Index residential incentives
    - Index performance-based incentives (PBI)
2. Adopt VOS valuation & develop new tariff, modify billing
3. Improve VOS calculations & values

Common Questions

- What about intermittence?
- Does annual change make this unpredictable?
- Are valuation components subjective?
- What about lost revenues (stranded costs)?
- What about increasingly fixed/unavoidable costs?
- What happens when we get a lot of solar?
- Doesn't IRP take care of solar?
- Why do study results vary so much?

Thanks!

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