Value of Solar Tariff

Will it work in Washington State?

Ahlmahz Negash
EE 500E Seminar
10-16-2014
Net Energy Metering

“This is a stable and highly successful policy. We need to maintain net metering, not ‘fix’ it.”

-Anne Smart, TASC Executive Director
Why is this an issue?

1. Rocky Mountain Institute, “Rate Design for the Distribution Edge”, August 2014
Why is this an issue?

- Poor Retail Rate Design
  - Volumetric, not cost reflective

- Poor DER Pricing Mechanisms
  - Incentive-based, not value-based

“Todays rates are an increasing reflection of yesterday’s grid”.

1. Rocky Mountain Institute, “Rate Design for the Distribution Edge”, August 2014
Legislation to Eliminate or Alter NEM

As of August 2014

Enacted/Approved
Under Consideration
Defeated or Abandoned

NC Clean Energy Technology Center, “Rethinking Standby Charges and Fixed Cost Charges: Regulatory and Rate Design Pathways to Deeper Solar PV Cost Reductions”, August 2014
Value of Solar (I)

“The right price mechanism for a forward-looking technology is not backward-looking costs.”

-Karl Rabago, Former Texas Regulator and Utility Executive
Value of Solar Tariffs (VOST)

• Lifetime economic value of solar to the utility.
• “Buy All. Sell All.”

• Clean Power Research
  • Austin Energy – 2012
  • Minnesota - 2014
Value of Solar Tariffs Design Process

- Identify Value Components
- Quantify Economic Value
- Calculate VOST
Step 1: Identify Value Components

**Energy Benefits**
- Avoided fuel cost
- Avoided variable plant O & M costs
- Avoided energy loss
- Energy hedge value

**Capacity Benefits**
- Generation Capacity
- Reserve Capacity
- Transmission & Distribution Capacity
- Fixed O & M Plant Costs

**Ancillary Benefits**
- Voltage Regulation
- Other Benefits

**Externalities**

- **Environmental Benefits:**
  - Reduced RPS Need
  - REC Sales
  - Reduced Carbon
  - Other Benefits

- **Societal Benefits**
  - Local Economy
  - Stimulates technology
  - Other benefits

Straightforward | Complex
Step 2: Quantify Economic Value

• Calculate 25-year levelized cost of each value component

• Process:
  • Estimate marginal solar production for 25 year period
  • Estimate discounted utility costs for each “value component”
  • Value-based price is the discounted cost divided by the discounted production

\[
VOS_{\text{component}} = \frac{\sum_{\text{year}=0}^{\text{PVLife}-1}\text{Discounted Utility Costs}_{\text{year}}}{\sum_{\text{year}=0}^{\text{PVLife}-1}\text{Discounted PV Production}_{\text{year}}}
\]
Example: Value of Avoided Fuel Costs

\[ VOS_{\text{fuel}} = \frac{\sum_{\text{year}=0}^{24} \text{BurnerFuelPrice}_{\text{year}} \cdot \text{SolarWeighedHeatRate}_{\text{year}} \cdot \text{PVProduction}_{\text{year}} \cdot \text{RiskFreeDiscountFactor}_{\text{year}}}{\sum_{\text{year}=0}^{24} \text{PVProduction}_{\text{year}} \cdot \text{RiskFreeDiscountFactor}_{\text{year}}} \]

Where,

\[ \text{RiskFreeDiscountFactor}_{\text{year}} = \frac{1}{(1 + r)^{\text{year}}} \]

\[ \text{PVProduction}_{\text{year}} = \sum_{\text{hour}=1}^{\text{PV Fleet Shape}} \text{PV Fleet Shape}_{\text{hour}} \cdot (1 - p)^{\text{year}} \]

\[ \text{SolarWeighedHeatRate}_{\text{year}} = \frac{\sum_{\text{hour}=1}^{\text{Heat Rate}} \text{Heat Rate}_{\text{hour}} \cdot \text{PV Fleet Shape}_{\text{hour}}}{\sum_{\text{hour}=1}^{\text{PV Fleet Shape}} \text{PV Fleet Shape}_{\text{hour}}} \cdot (1 + h)^{\text{year}} \]

\[ \text{BurnerFuelPrice}_{\text{year}} = \begin{cases} \text{NG Price}_{\text{year}} + \text{Fuel Price Overhead} \cdot (1 + g)^{\text{year}}, & \text{year} = 0 \ldots 11 \\ \text{NG Price}_{11} \cdot (1 + g)^{\text{year}}, & \text{year} = 12 \ldots 24 \end{cases} \]
## Results 1: Value of Avoided Fuel Costs

<table>
<thead>
<tr>
<th>Year</th>
<th>Guaranteed Fuel Prices</th>
<th>Burnertip Fuel Price</th>
<th>Solar Weighed Heat Rate</th>
<th>Utility Price</th>
<th>VOS</th>
<th>p.u. PV Production</th>
<th>Utility</th>
<th>VOS</th>
<th>Discount Factor (risk free)</th>
<th>Utility</th>
<th>VOS</th>
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<tbody>
<tr>
<td></td>
<td>$/MMBtu</td>
<td>$/MMBtu</td>
<td>(Btu/kWh)</td>
<td>$/kWh</td>
<td>$/kWh</td>
<td>(kWh)</td>
<td>($)</td>
<td>($)</td>
<td>($)</td>
<td>Utility</td>
<td>VOS</td>
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<td>$4.43</td>
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</table>

**Validation: Present Value**

|       | $991.54 | $991.54 |
Step 3: VOST Calculation

\[
VOST = \sum_{i}^{\text{numComponents}} \frac{VOS_i \times \text{LoadMatchFactor}_i \times (1 + \text{LossSavingsFactor}_i)}{	ext{LoadMatchFactor}_i} = \begin{cases} 
\text{PLR}_{\text{without losses}} & \text{for dist capacity component} \\
\text{ELCC}_{\text{without losses}} & \text{for other capacity components} \\
1 & \text{for energy dependent components}
\end{cases}
\]

Where,

\[
\text{LossSavingsFactor}_i = \begin{cases} 
\text{LossSavings}_{\text{PLR}} & \text{for dist capacity component} \\
\text{LossSavings}_{\text{ELCC}} & \text{for other capacity components} \\
\text{LossSavings}_{\text{Energy}} & \text{for energy dependent components}
\end{cases}
\]
Load Match Factors (Winter Peaking Region)

Effective Load Carrying Capacity (ELCC)  Peak Load Reduction (PLR)

ELCC = 0.0047  PLR = 0
Value of Solar Tariff

• Will this method work for Washington State?

Levelized Value of Solar (NG Cap.)

AvoidedFuel
AvoidedOMFixed
AvoidedOMVariable
AvoidedGenCap
AvoidedResCap
AvoidedTransCap
AvoidedDistCap
AvoidedEnviron

$0.096
Value of Solar Tariff

• Will this method work for Washington State?
  • Winter peaking
    • No capacity value!
  • Marginal fuel is NG and Hydro
    • Energy value is incorrect!
    • Env. Value is incorrect!

$0.096
Marginal Fuel Assumption...

50% NG & 50% Hydro

Levelized Value of Solar (Marginal Fuel: 50% NG)

<table>
<thead>
<tr>
<th>AvoidedFuel</th>
<th>AvoidedOMFixed</th>
<th>AvoidedOMVariable</th>
<th>AvoidedGenCap</th>
<th>AvoidedResCap</th>
<th>AvoidedTransCap</th>
<th>AvoidedDistCap</th>
<th>AvoidedEnviron</th>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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</tbody>
</table>

$0.073
Marginal Fuel Assumption...

50% NG & 50% Hydro

Levelized Value ($/kWh)

$0.073

20% NG & 80% Hydro

Levelized Value ($/kWh)

$0.059
Value of Solar (II)

A modified VOST methodology, more suited for the PNW...
Modified VOST

- Energy value = Mid-C Forecast
- Load Match = Capacity Factor
- Env. Value = Reduced RPS Needs + REC Sales
- REC=$1/REC

Levelized Value of Solar ($1 REC)

$0.065
One more time...

- Energy value = Market Price
- Load Match = Capacity Factor
- Env. Value = Reduced RPS Needs + REC Sales
- REC=$50/REC

$0.122
Value of Solar (III)

Weighted Retail Rate
Weighted Retail Rate

• Combines benefits of NEM and VOST
• Not a levelized value
• Requires disaggregated retail rates
Disaggregated Rate Design

Utility Costs

- **Energy**
  - $$/kWh
- **Demand**
  - $$/kW
- **Customer**
  - $$/cust.
- **Ext.**
  - $$/X

Retail Rate

- **Energy**
  - $$/kWh
- **Demand**
  - $$/kW or $$/kWh
- **Customer**
  - $$/cust.
- **Ext.**
  - $$/kWh
Weighted Retail Rate

\[ VOST = R \times \rho_{eng} \times w_{eng} + R \times \rho_{dem} \times w_{dem} + R \times \rho_{cust} \times w_{cust} + envX \]

\[ w_{eng} = \frac{1}{\text{SolarHours}} \sum_{s=1}^{\text{SolarHours}} \text{MarketPrice}_s \]
\[ \rho_{eng} = \frac{\text{EnergyCosts}}{\text{TotalCosts}} \]
\[ w_{dem} = \frac{1}{\text{TotalHours}} \sum_{t=1}^{\text{TotalHours}} \text{PVFleetShape}_t \]
\[ \rho_{dem} = \frac{\text{DemandCosts}}{\text{TotalCosts}} \]
\[ w_{cust} = 0 \]
\[ \rho_{cust} = \frac{\text{CustomerCosts}}{\text{TotalCosts}} \]
Results: Weights and Cost Proportions

<table>
<thead>
<tr>
<th>R ($/kWh)</th>
<th>v ($/kWh)</th>
<th>$\rho_{\text{eng}}$ (%)</th>
<th>$\rho_{\text{dem}}$ (%)</th>
<th>$\rho_{\text{cust}}$ (%)</th>
<th>$w_{\text{eng}}$ (%)</th>
<th>$w_{\text{dem}}$ (%)</th>
<th>$w_{\text{cust}}$ (%)</th>
<th>VOS ($/kWh)</th>
</tr>
</thead>
<tbody>
<tr>
<td>$0.089$</td>
<td>$0.001$</td>
<td>0.55</td>
<td>0.35</td>
<td>0.1</td>
<td>1.13</td>
<td>0.11</td>
<td>0</td>
<td>$0.060$</td>
</tr>
<tr>
<td>$0.089$</td>
<td>$0.001$</td>
<td>0.65</td>
<td>0.25</td>
<td>0.1</td>
<td>1.13</td>
<td>0.11</td>
<td>0</td>
<td>$0.069$</td>
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<tr>
<td>$0.089$</td>
<td>$0.001$</td>
<td>0.40</td>
<td>0.50</td>
<td>0.1</td>
<td>1.13</td>
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<td>0.55</td>
<td>0.35</td>
<td>0.1</td>
<td>1.25</td>
<td>0.40</td>
<td>0</td>
<td>$0.075$</td>
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</table>
# Methodology Comparison

<table>
<thead>
<tr>
<th>Methodology</th>
<th>Value Component Complexity</th>
<th>Cost Shifting Risk</th>
<th>Under-Value Risk</th>
<th>Over-Value Risk</th>
</tr>
</thead>
<tbody>
<tr>
<td>VOST (I)</td>
<td>High</td>
<td>Low</td>
<td>High</td>
<td>Low*</td>
</tr>
<tr>
<td>VOST (II)</td>
<td>Med</td>
<td>Low</td>
<td>High</td>
<td>Low*</td>
</tr>
<tr>
<td>VOST (III)</td>
<td>Low</td>
<td>Low</td>
<td>Med</td>
<td>Med</td>
</tr>
<tr>
<td>NEM</td>
<td>Very Low</td>
<td>High</td>
<td>Low</td>
<td>High</td>
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</table>
Conclusion

Washington State VOST: Policy Implications
Policy Implications...

Solar Policy
- Policy rewards supply
- Policy creates demand

Incentive-Based
- NEM
- Tax Credits
- Production Credits

Standard-Based
- RPS (Solar)
- REC/SREC
- ACP Rate

Value of Solar
- EPA SCC
- ...

Value of Solar
- Tariff

VOS justifies incentive level
VOS sets prices (e.g., ACP)
VOS determines rate
VOST: A good idea?

Yes

1. VOST is fair and just compensation method for everyone.
2. VOST is more economically sound and efficient than current net metering policies.
3. VOST can optimize solar penetration and location without arbitrary caps.

No

1. Without strong solar policies, the value of solar is low in Washington.
2. A VOST is not likely to be high enough to drive local solar economy.
3. Uncertainty in future policies can place financial risk on utilities and/or undervalue solar.
Summary

• Many factors influence VOST calculations
  • Economic assumptions
  • Regional characteristics
  • Federal and state RE/solar policies

• A successful Washington State VOST would:
  • require monetizing additional externalities
  • be very policy dependent
  • address the need to restructure rates
Thank you!