



DTE Energy[®]

The Fair Market Value of Solar: A Current State View

May 20 2014



- DTE Energy valued components of the Minnesota Value of Solar (VoS) model based on 2013 historical data from the DTE Energy Training and Development Center (TDC) Solar Array in Westland, MI
- This data includes time-synchronized production data, nodal circuit distribution data, 2013 DTE Day Ahead Locational Marginal Price (LMP) data, and the MISO Planning Resource Auction Clearing Price (ACP)
- By using actual market values instead of theoretical data, imputed costs, and/or hypothetical or future projections, we have calculated the current fair market value of distributed solar generation that does not reflect cross subsidies or result in inaccurate market signals

We reviewed components of the Minnesota VoS methodology to calculate a 2013 true value of Michigan distributed solar generation



Components of the Minnesota VoS

Fuel Cost

Variable O&M Costs

Generation Capacity Cost

Line Losses & Congestion

Fixed O&M Costs

Distribution Capacity

Transmission Capacity

Environmental Costs

Actual Current State

Avoided fuel costs are represented in the Day Ahead LMP

Avoided variable O&M costs are represented in the Day Ahead LMP

Avoided costs are based on MISO Planning Resource ACP

Transmission and distribution line losses are included

No fixed O&M cost was avoided through solar PV

No distribution capacity cost was avoided through solar PV

No transmission capacity cost was displaced through solar PV

Avoided environmental costs are represented in the Day Ahead LMP



Through an analysis of actual solar production data and real market costs, we estimate the 2013 fair market value of distributed solar generation as \$0.039/kWh

Actual data from DTE Energy Training and Development Center was used in our value of solar calculation



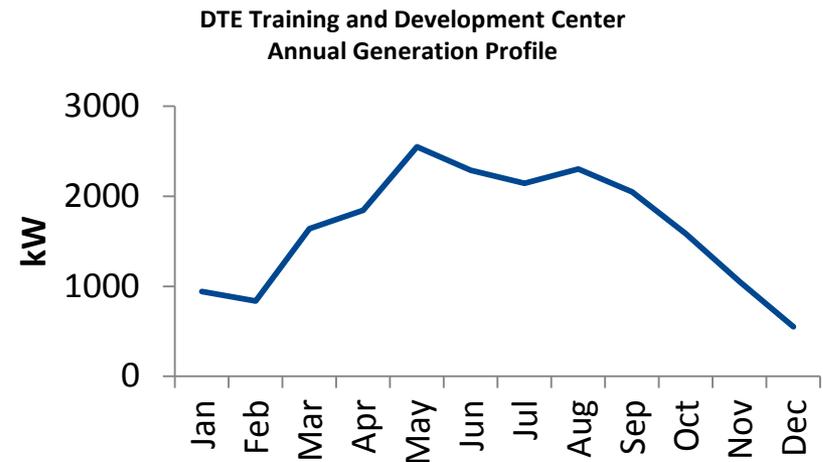
Load Analysis Data

- 2013 hourly generation for Training and Development Center (TDC) was used
 - 386 kW DC (375 AC)
 - Fixed ground mounted, south facing array
 - 14.4% NCF



Load-Match Factors

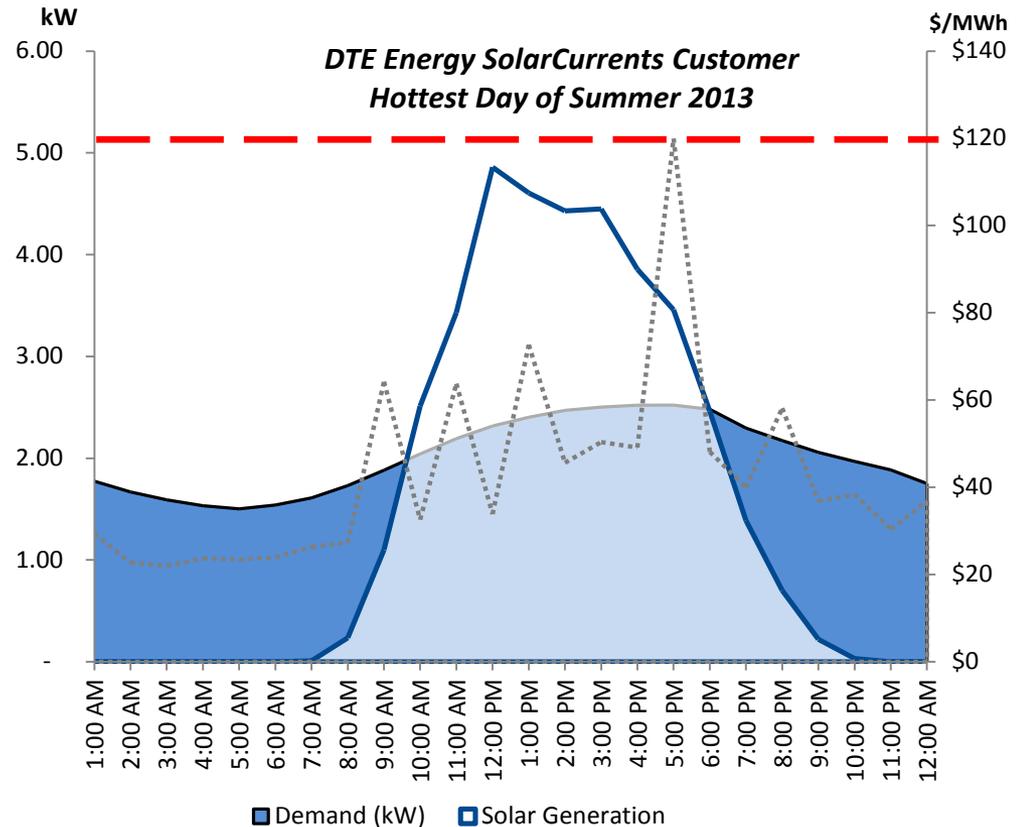
- Effective Load Carrying Capability (ELCC)
 - Calculated from PV Fleet Shape for peak hours ending 3 pm – 5 pm EST during June, July and August
- Peak Load Reduction (PLR)
 - Distribution load (hourly) at TDC circuit



The Locational Marginal Price was used to calculate Avoided Fuel Cost and Avoided Plant Variable O&M



- Assumptions on distribution losses are based on DTE Energy secondary line loss study – 11.95%
- Transmission losses are captured in MISO Day Ahead Locational Marginal Pricing
- Distributed PV generation avoids wholesale energy purchases
- Avoided annual energy at the grid is calculated as the sum of the hourly PV Fleet Shape across 8760 hours of the Load Analysis Period, grossed up for losses
- As a result, the avoided fuel cost and variable O&M is \$0.0388/kwh

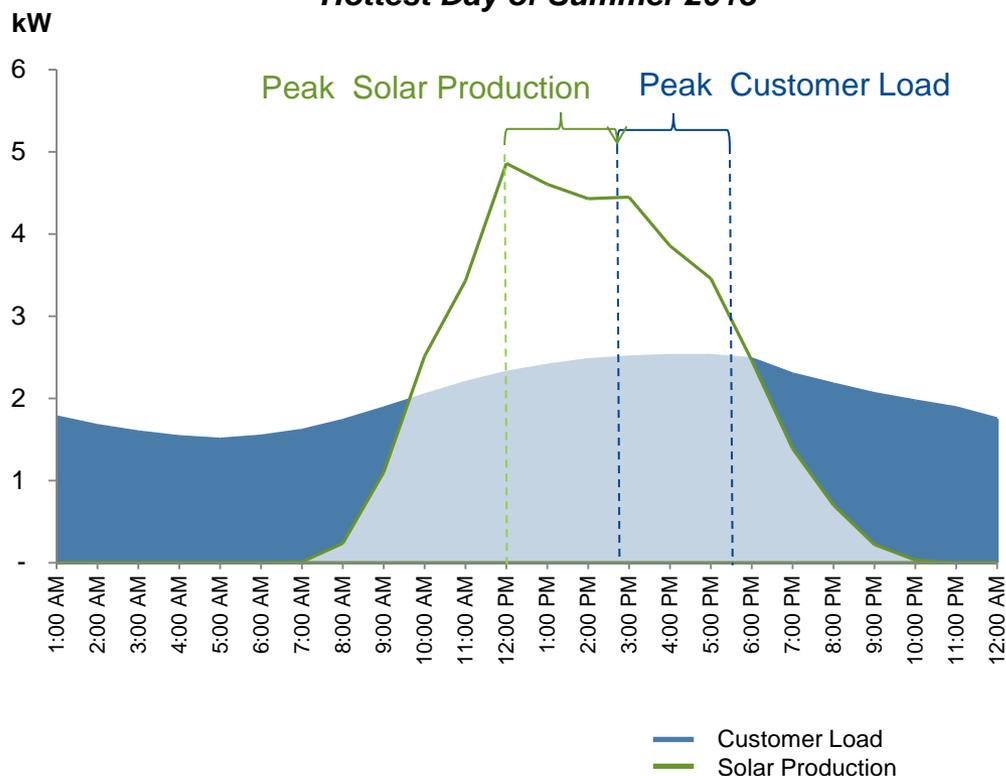


The 2013/2014 MISO Planning Resource Auction Clearing Price (ACP) for capacity accurately depicts the avoided generation capacity cost displaced by solar



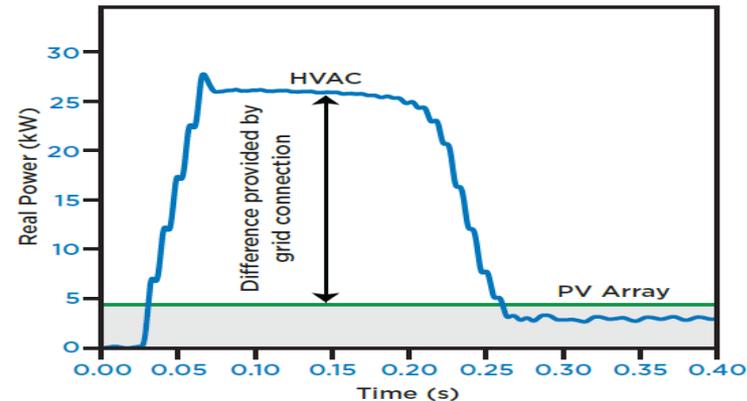
- Solar resource is variable and peak solar production does not align well with peak customer load.
- MISO ACP in 2013 was \$1.05/mw-day (\$383/mw – year or \$0.383/kw-year)
- The displaced annual energy was 1392 kWh
- The ELCC in 2013 was 41%
- Avoided generation capacity cost is $(\$0.38/\text{kw-yr}/1392 \text{ kWh}) = \$0.00028/\text{kWh}$

**DTE Energy SolarCurrents Customer
Hottest Day of Summer 2013**

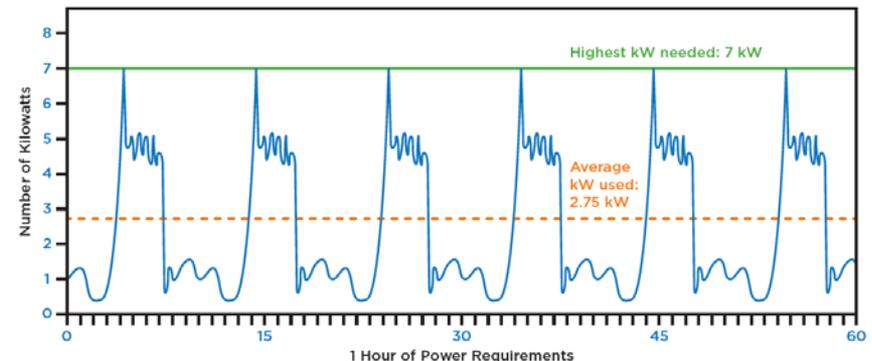


Currently Fixed O&M, distribution and transmission capacity costs are not avoided

- Due to variability in solar generation and out of sync utility peak load to solar production, fixed costs that are displaced by solar are unpredictable
- With the typical Michigan air conditioner turning on 3-6 times an hour, roof top solar customers use the grid up to a half-dozen times an hour, even during hours when the customer is receiving credit for being a net provider
- In order to assure reliability under all circumstances, DTE Energy must maintain the grid as if these PV arrays were not available



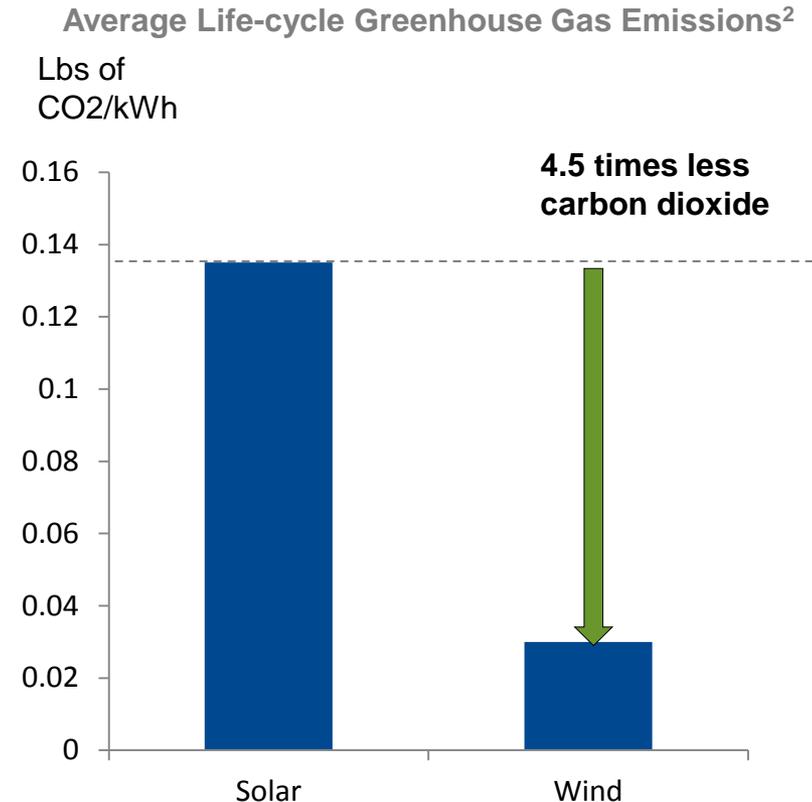
2014 The Integrated Grid: Realizing the Full Value of Central and Distributed Energy Resources, Electric Power Research Institute



Environmental and other social benefits should not be a part of utility rate-making



- Avoided Environmental cost components are unpredictable and speculative
- Large scale wind offers the same environmental benefits as solar while in service, but account for 4.5 times less carbon dioxide¹ over the entire life cycle



¹ Union of Concerned Scientists: Benefits of Renewable Energy Use

² The average life-cycle greenhouse gas emissions calculation includes manufacturing, installation, operation, maintenance, and decommissioning

Based on actual production and distribution load profile, the fair market value of solar in 2013 was \$0.039/kwh



Components of the Minnesota VoS

Fuel Cost and Variable O&M Costs	\$0.0388/kWh
Generation Capacity and Reserve Capacity Cost	\$0.00028/kWh
Fixed O&M Costs	Not Avoided
Distribution Capacity	Not Avoided
Transmission Capacity	Not Avoided
Environmental Costs	Included in Fuel and Variable O&M Cost
DTE Value of Solar in 2013	\$0.039/kwh