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**Meeting the Challenge of
Zero Net Energy by 2030**
September 2016

RENEWABLE TECHNOLOGY OVERVIEW

Common “renewable” technologies for ZNE

- Solar PV
- Battery Storage

Not as common

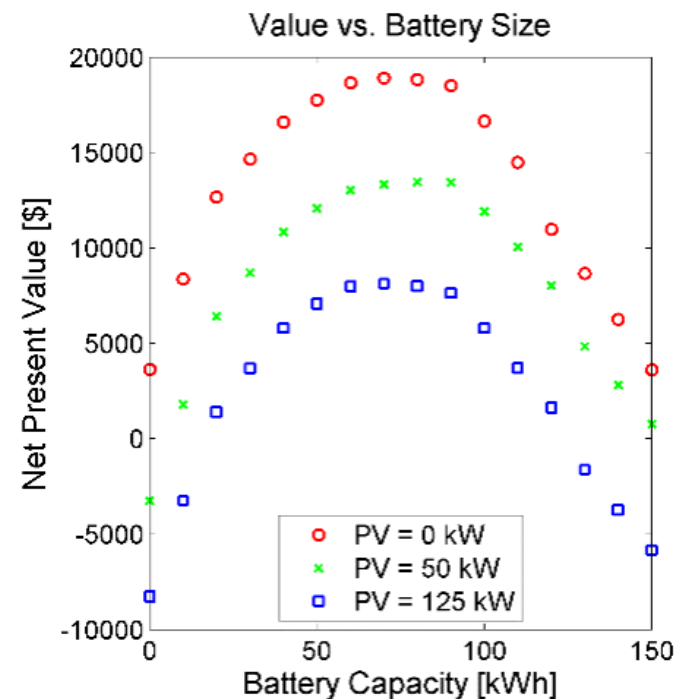
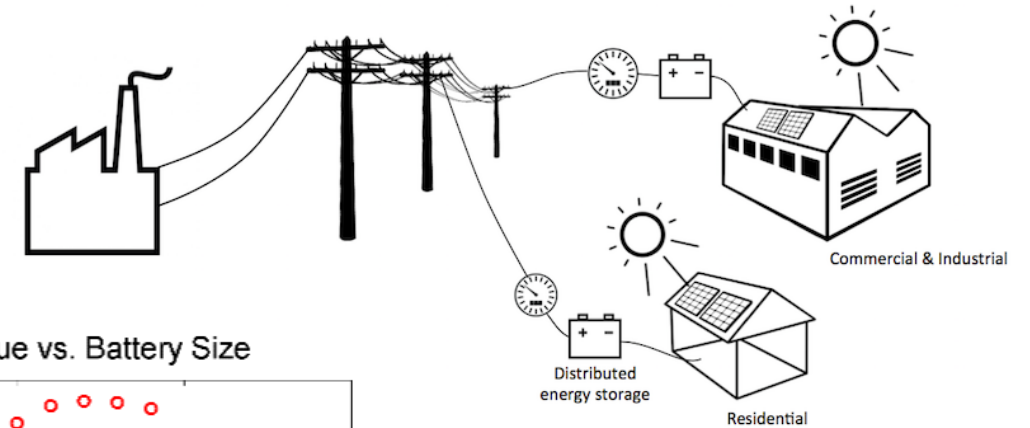
- Solar Thermal
- Wind



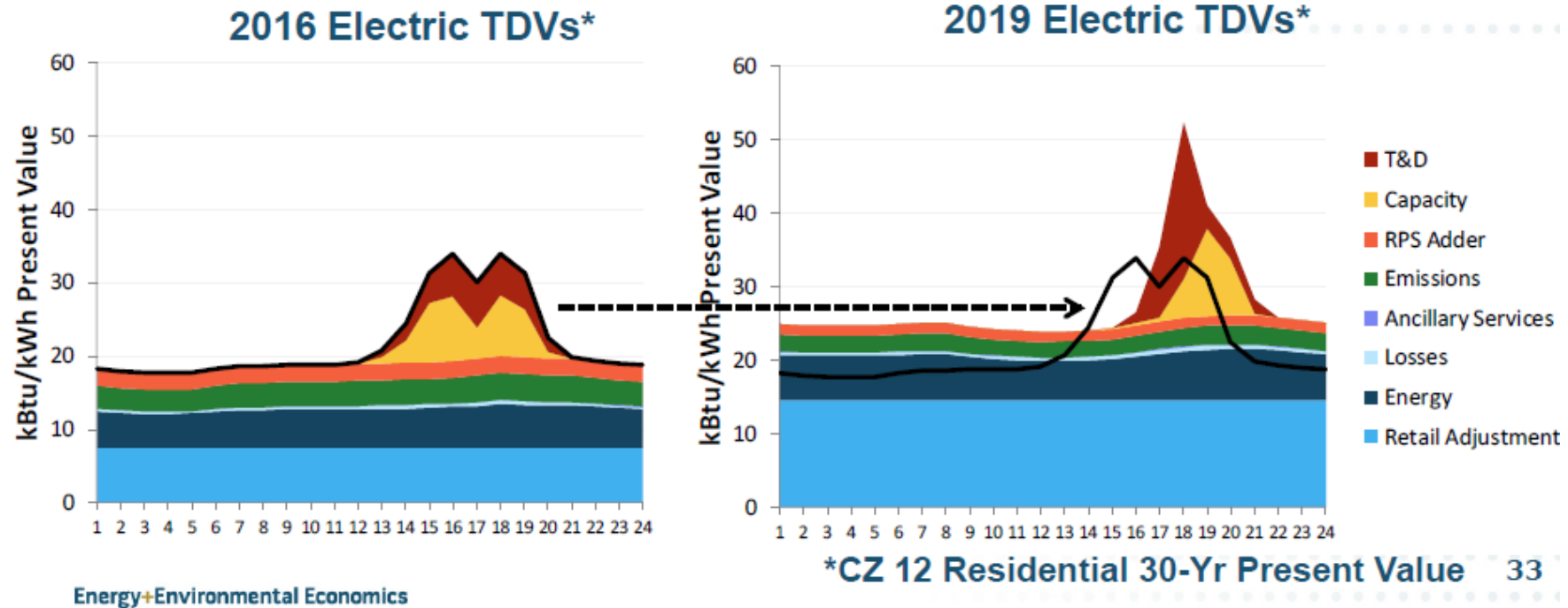
RENEWABLES AND ZNE PROJECTS

Design considerations

- Behind the meter
- Solar
 - Roof design
 - Parking lot and grounds
- Battery Storage
 - Optimal sizing with and without solar
 - Typically 3-1 ratio, PV to battery
 - Cost of metering (NGOM, \$50k)



2019 TITLE 24 ZNE TDV

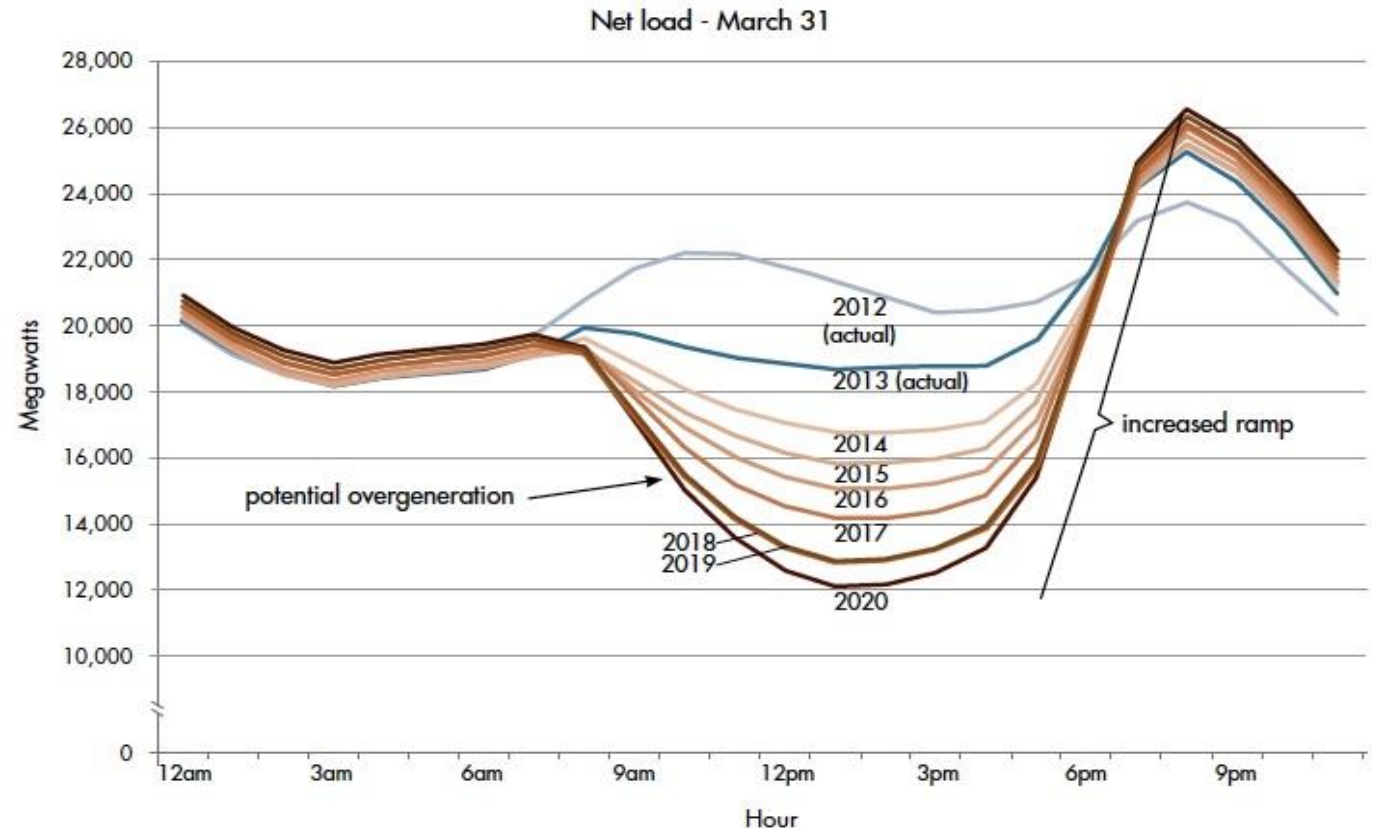


- TDV shifting to early evening
- Solar PV cannot address this shift directly, requires storage

UTILITY GRID CONSIDERATIONS

Impact of Distributed Renewable Generation on Utility Grids

- Intermittency
- Conventional reserves
- Storage
- The “Duck Curve”
- Minimum generation problem
- Curtailment
- The Smart Grid
- Stand-alone operation



FINANCING RENEWABLES

Overview

- **Solar PV is a mature market:**
 - System performance and financing structures well understood
 - Developers and projects are financeable
- **Solar Thermal and Batteries much less so:**
 - System performance and reliability?
 - Financial viability of manufacturers and developers?

FINANCING TYPES

Power Purchase Agreements

- Third party ownership – little to no cost to host
- Power purchased (kWh), not assets
- Base rate (\$/kWh) plus annual escalator (%)
- Buyout options after year 6
- End of contract provisions (purchase, extend, remove)
- Prepayment
- Incentives are aligned properly

FINANCING TYPES

Leases and Loans

- **Operating Lease (renting)**
 - Treated as being owned by the lessor
 - Payments treated as operating expenses
 - Tax benefits/obligations to lessor
 - Off balance sheet
- **Capital Lease (loan)**
 - Treated as being owned by the lessee
 - Tax benefits/obligations to lessee
 - On balance sheet
 - Bargain purchase at end of lease



FINANCING TYPES

Leases and Loans (continued)

- **Municipal Lease (tax exempt lease-purchase - TELP)**
 - Tax-exempt (interest tax exempt to lessor)
 - Annual appropriation (not “debt”)
 - Like a loan: customer has title and owns asset at term end
 - Treated as a Capital Lease
 - No encumbrance of tax or other revenues
 - Relatively easy to structure and issue

FINANCING TYPES

PACE (Property Assessed Clean Energy)

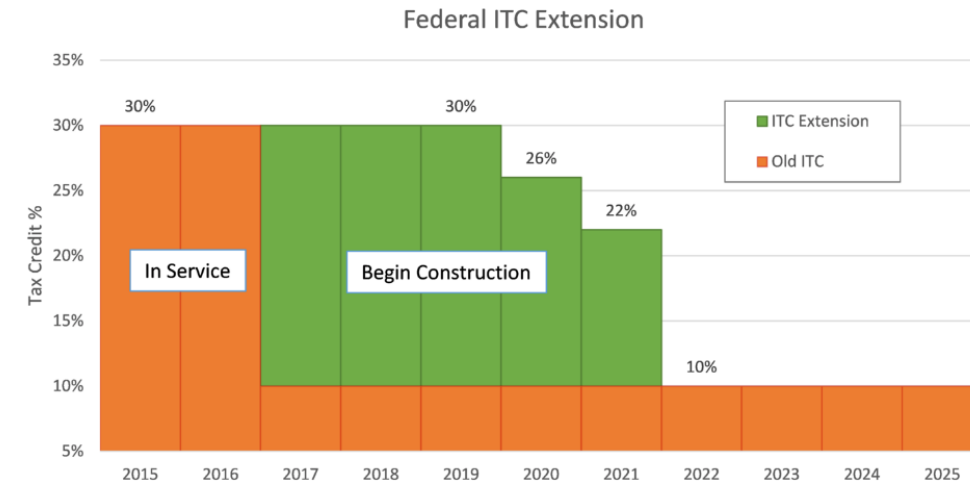
- Many communities in CA
- Up to 100% financing
- Assessment added to property tax bill
- Can be shared with tenants
- Qualified PACE service providers in each area



TAX BENEFITS AND INCENTIVES

Federal Tax Benefits and Incentives

- **ITC (Investment Tax Credit)**
 - 30% of project costs (through 2019)
 - Applies to solar, wind, fuel cells
 - Sunsets gradually: 26% in 2020; 22% in 2021, 10% thereafter
- **MACRS (Modified Accelerated Cost Recovery System)**
 - Solar PV – 5-year MACRS, 50% first year bonus
 - Applies to solar, wind, geothermal, fuel cells, CHP
 - ITC reduces depreciation basis by 50% of ITC



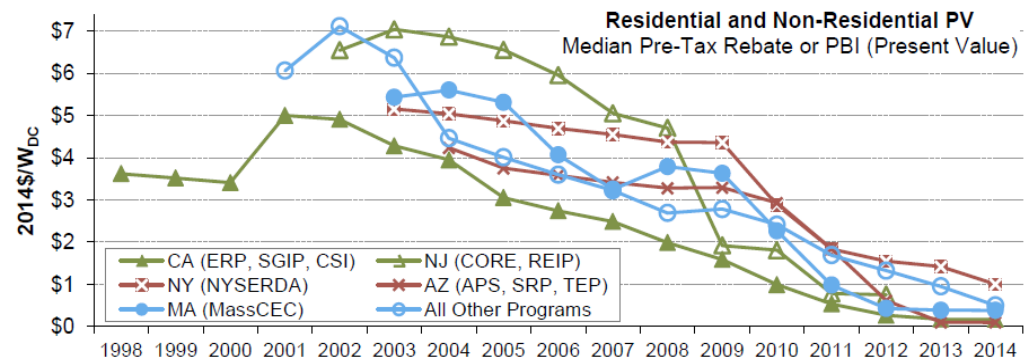
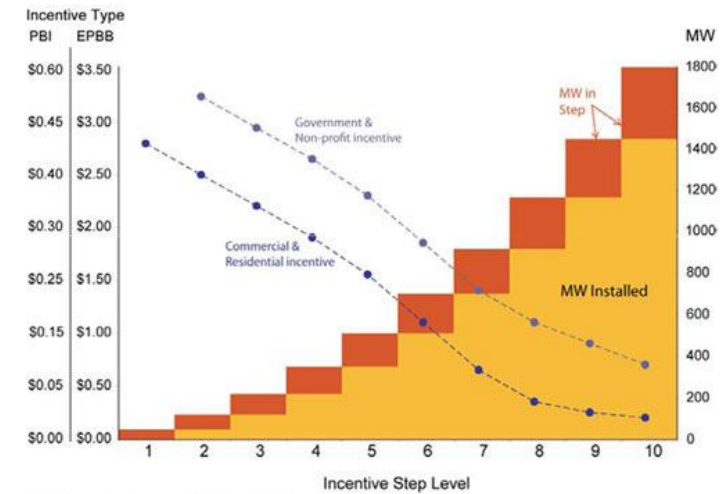
TAX BENEFITS AND INCENTIVES

Federal Tax Benefits and Incentives (continued)

- REAP (Rural Energy for America Program) Grant
- CREBs (Clean Renewable Energy Bonds)
- DOE Loan Guarantees

State and Local Tax Benefits and Incentives

- Limited utility and local (county, city) incentives
- Specific to sponsor entity



BATTERY STORAGE

State of the BES Industry

- **Companies**

- Many, mostly young
- Hardware, software and financing

- **Financing**

- How to assess value and price
- Mostly provided by vendor

- **Cost of Battery Systems**

- 40-50% reduction in Li-Ion battery by 2021 (GTM)
- 40-50% drop in BOS costs (GTM)



BATTERY STORAGE

State of the BES Industry

- **Incentives**
 - SGIP currently exhausted
 - ITC when paired with solar
 - 5-year claim period
 - 75% cliff
 - no greater than min provided by solar during ANY year
- **Lack of Transparency**
 - M&V provided by vendor
 - Typically, no independent audit
- **Tariff Reliance**
 - Likely to increase value over time

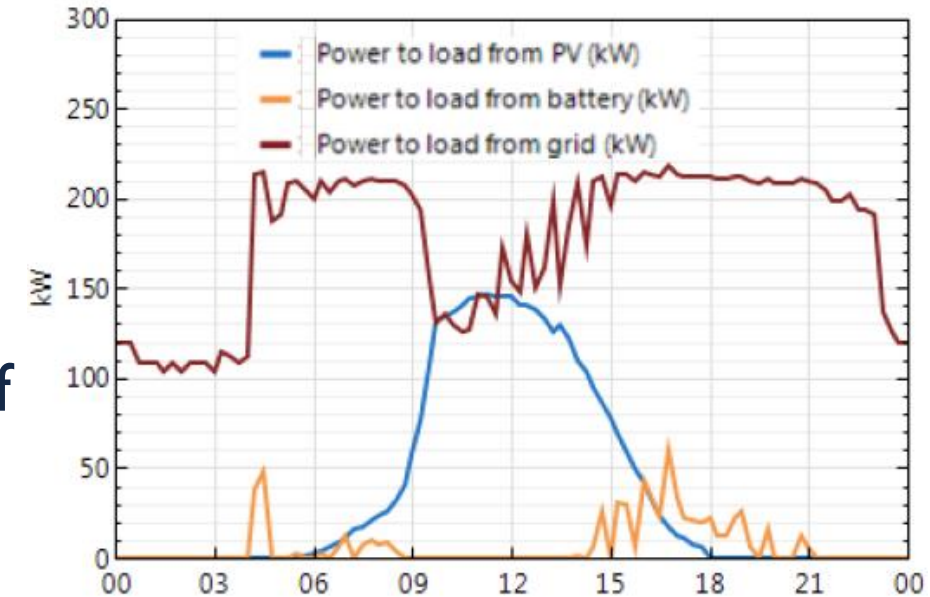
Technology Type	Incentive (\$/W)
Renewable and Waste Energy Recovery	
Wind Turbine	\$1.02
Waste Heat to Power	\$1.02
Pressure Reduction Turbine	\$1.02
Non-Renewable Conventional CHP	
Internal Combustion Engine - CHP	\$0.42
Micro-turbine – CHP	\$0.42
Gas Turbine – CHP	\$0.42
Emerging Technologies	
Advanced Energy Storage	\$1.31
Biogas Adder	\$1.31
Fuel Cell – CHP or Electric Only	\$1.49



BATTERY STORAGE

Applications

- **Demand Charge Reduction**
 - The primary application today
- **Tariff Eligibility**
 - May allow transition to more economical tariff
- **Time-of-Use Arbitrage**
 - Not normally economic, but coming
- **Backup Power**
 - Rarely used, typically provided by onsite generation
- **Grid Services**
 - Not today, but future value helping manage grid loads



BATTERY STORAGE

Project Financing

- Usually provided by Battery firm
- The biggest barrier to understanding and comparing battery product offerings
- Careful when pairing with solar
- **Who Bears the Risk?**
 - Shared savings only, not shared cost (Green Charge)
 - Fixed price for demand reduction with payback (SolarCity)
 - Leases/PPAs

FINANCIAL RETURN RISKS

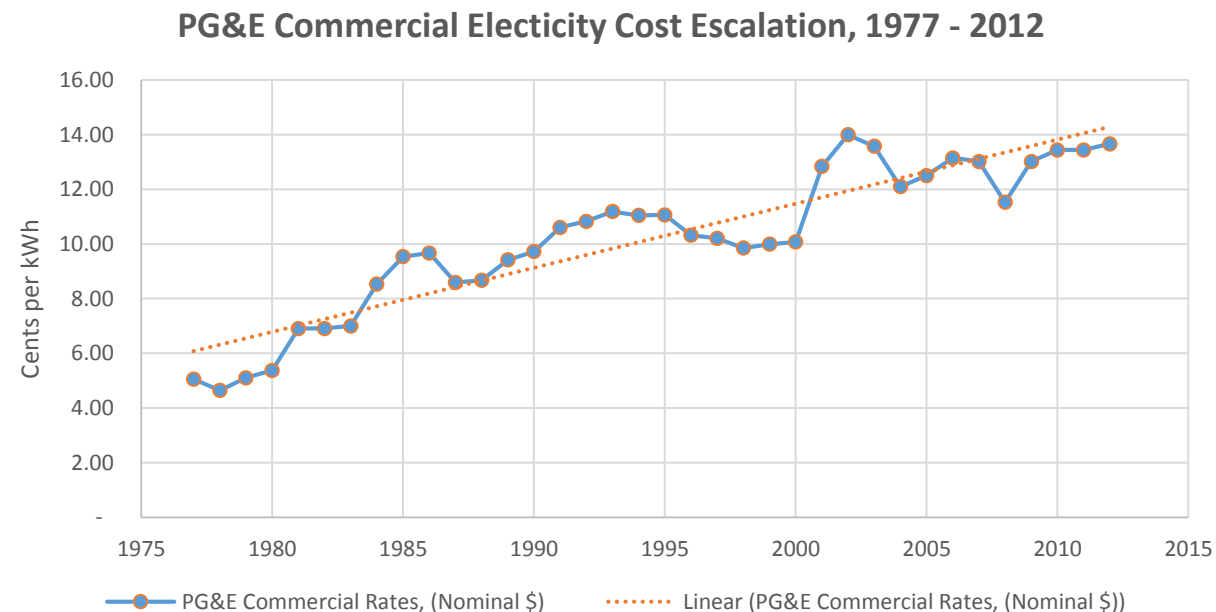
Risk in Rate Based Incentives

- **Net Energy Metering (NEM)**
 - 43 States, policies differ from state to state
 - Political football – based on legislative policy objectives
 - Currently 35 NEM debates in 22 states
 - Cost shifting
 - Relies on underlying rate tariffs
- **“Solar Friendly” tariffs**
 - No guarantee that tariff will remain the same, in fact, just the opposite
 - Incentives will decrease as policy objectives achieved

FINANCIAL RETURN RISKS

Utility Business Models and Cost Allocation

- **Trend toward higher Demand charges**
 - Facilities related charges increasing:
 - Upgrade to Smart Grid
 - Transmission expansion
 - PUCs sending price signals
- **Changes in TOU periods**
 - The Duck Curve
- **Fossil fuel cost**



FINANCIAL RETURN RISKS

Cautionary Examples

▪ Nevada

- NEM eradicated, 3x fixed service charge, reduced solar credit by $\frac{3}{4}$ (~~since extended to 12-year phase in~~) **20-year grandfathering**
- December 2015 rate changes for new NEM customers remain

▪ Hawaii

- NEM eradicated but existing customers grandfathered
- Feed-In-Tariff implemented that radically reduces the value of solar in Hawaii
- Curtailment issues in some places

For more information:



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