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# Payback Period of Microgrids After IRA

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# Summary

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- As a result of IRA, the payback period for a behind-the-meter solar generation is 7 to 15 years for most of the country for large residential users, 10 to 15 years for large commercial users and 15+ for large industrial users with current retail rates and less than 10 years if we assume an annual 3% rate increase.
- **The short payback periods imply that net-metering rates across the country will sooner or later will be rolled back.**
- A battery storage and a generator can be paid off as a result of value of load loss (VOLL), demand response/ancillary payment and transmission savings.
- Outside of few states it is hard to economically justify adding a stand-alone behind-the-meter battery storage while VOLL almost always justifies a generator for large C&I users.
- Combining battery storage and solar generation will not change the payback periods because of round trip losses since IRA now provides tax equity independently.
- The only reason to combine them is the lack of net-metering and in this case, solar generation should be maximized under the area and demand constraint.
- PPA for a solar and battery storage makes sense only in few states if the energy component matter. But if the PPA buyer appreciate VOLL and T&D savings, then it will make sense in few more states.

# Microgrid Design



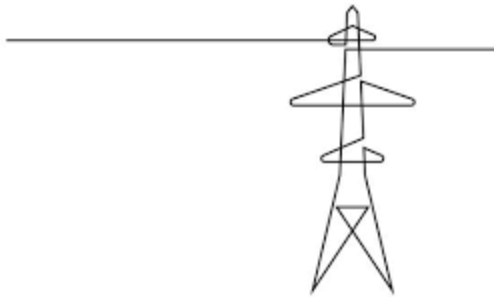
> 500 kW  
\$2000 - \$3500 per kW



> 500 kW  
2-hour duration  
\$750 - \$1250 per kW

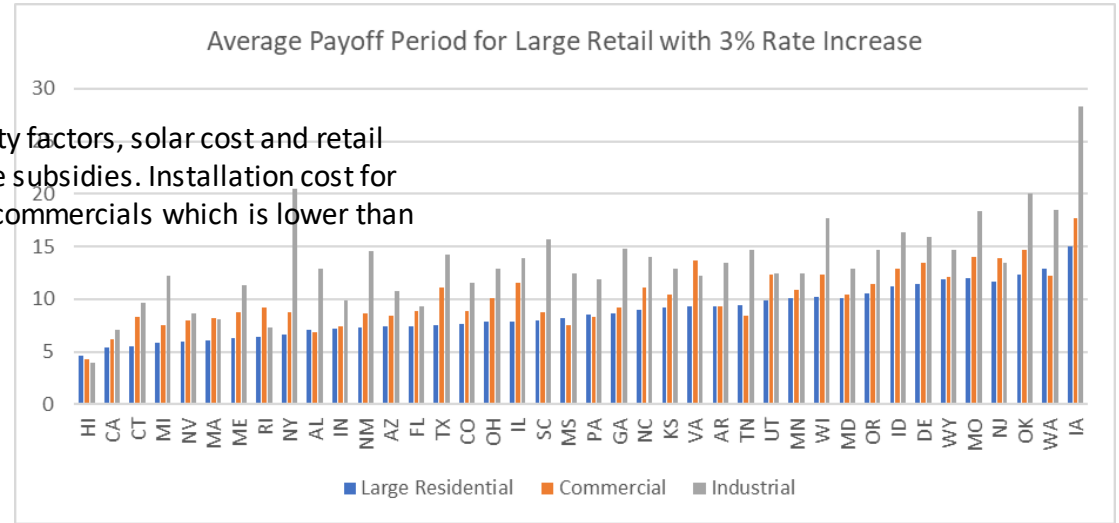
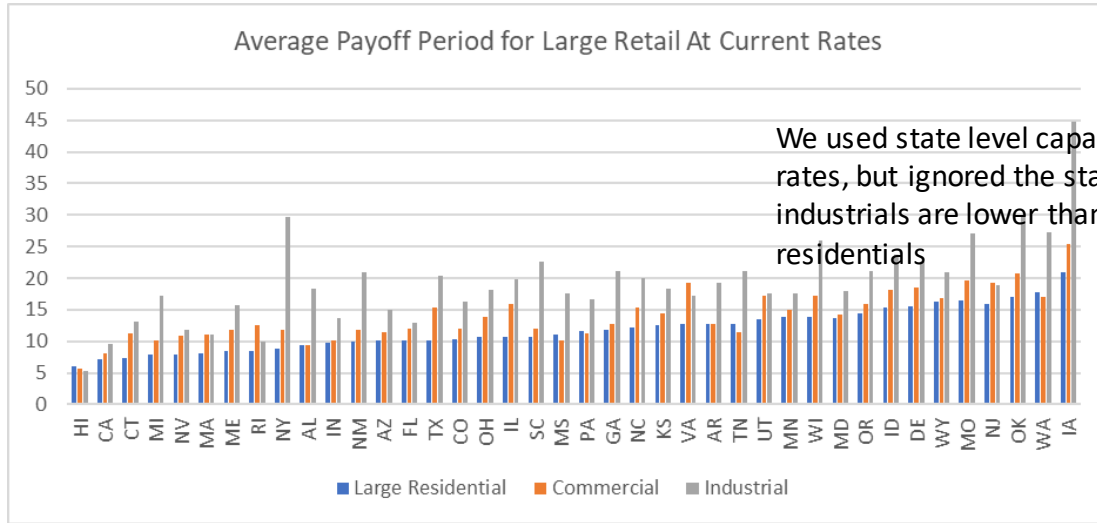


> 500 kW  
\$300 - \$750 per kW



> 500 kW

# Payback Period for Solar Generation



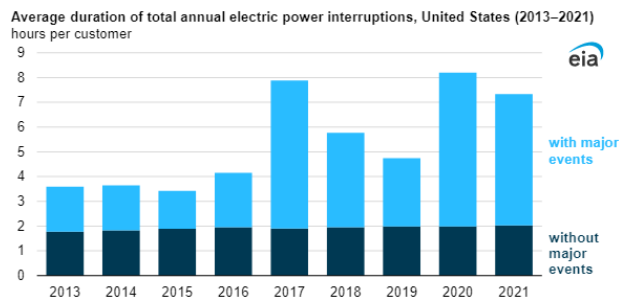
Cap Factor/Retail Cost (c/kWh)	Pay Off Years							
	30	27	24	21	18	15	12	9
18%	4	4	5	5	6	7	9	12
17%	4	4	5	6	7	8	10	13
16%	4	5	5	6	7	8	10	14
15%	4	5	6	6	7	9	11	15
14%	5	5	6	7	8	10	12	16
13%	5	6	6	7	9	10	13	17
12%	6	6	7	8	9	11	14	18
11%	6	7	8	9	10	12	15	20

In 2030 ←      ← Current

- We assume net metering (majority of states have net metering, but we expect them to slowly disappear or to be limited to wholesale prices).
- These calculations also assume zero equity discount rate and no debt.
- As expected, Industrial users are a tough sell since their payoff periods is longer (despite lower installation costs) and they do apply discount factors (which may lead them to reject projects more than 5 years).

# Pay Off Period for Responsive Generation Only

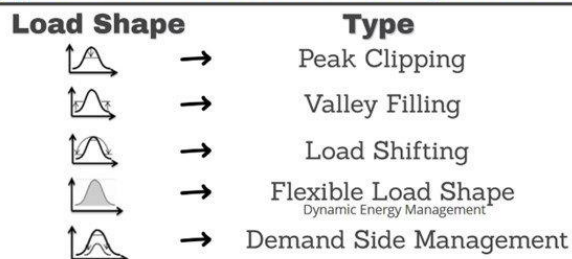
## Loss Load Savings



- Value of loss load (VOLL) is estimated to be somewhere between \$35/kWh - \$90/kWh

## Demand Response (DR) Savings

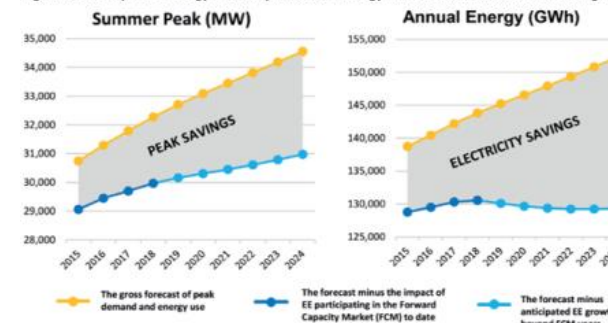
### Types of Demand Response



- Demand Response revenue can be between \$5/kW-year - \$20/kW-year.
- Time-of-rate use is another version of demand response.
- ISOs also offer ancillary revenues to the demand that can curtail less than 10 minutes.

## Transmission Savings

Figure 1. The Impact of Energy Efficiency on Annual Energy and Peak Load Growth in New England



Source: ISO-NE Regional System Plan 2015

- Only available in ISOs with deregulated electricity markets. It can range from \$50/kW-year to \$200/kW-year.

- DR and transmission savings may not be available in every state (for example Southeast States do not offer any).
- The payoff period of a generator is at least 5 times shorter than a battery storage. **But lack of NG will be an issue at one point.**
- Without subsidies, outside of New England and California, we do not see any possibility for a behind-the-meter battery storage to pay itself despite IRA savings.
- For example, in Texas, a battery storage can earn about \$50/kW from 4CP, \$50/kW from VOLL and \$10/kW from DR/Ancillary. The gross \$110/kW may not be payback a 2-hour battery that will cost \$1000/kW with ITC.

# Payback Period for Solar + Battery

Energy Revenue For A Battery Storage (\$/kW-year)						
Excess Production/Electricity Rate (c/kWh)	0.12	0.15	0.18	0.21	0.24	0.27
10%	17	21	25	29	34	38
20%	34	42	50	59	67	76
30%	50	63	76	88	101	114
40%	67	84	101	118	135	151
50%	84	105	126	147	168	189

Texas California

- Given the efficiency losses and ability earn tax credit in each separately, adding batteries to solar generation will not improve the payback period for neither when the net-metering is available. That may be the only economic reason we may think off to add a battery storage to a solar project rather than a generator.
- Oversizing solar generation (assuming there is enough land) may increase the payback period by few years while can pay off 5%+ of the cost of a battery and add the optionality of a battery.

# The Case For a PPA For Solar + Battery

- Ignoring the regulatory problems with offering a behind-the-meter PPA (may not be possible in half the states and wholesale market participation may not be allowed in half of the rest), we will try to answer if a PPA structure works for a solar + battery combination.
- The main problem with a PPA for battery storage is how to get paid for two main contributions of a battery storage: VOLL and T&D savings. Since these are savings rather than actual money transfers, they are not easy to quantify.
- As the chart indicates that including a battery just to make up for lack of net-metering only makes a PPA meaningful in very few states at the current cost structure. A PPA option may be more common in the future as the costs come off while retail prices continue to go off.
- Surprisingly, if PPA buyer puts a fair value for VOLL (around \$50/kWh) and T&D savings (available only in handful of states), number of states increases.
- But one complication in this case is that there has to be active management of battery storage in response to T&D savings and brown outs.

Wholesale market participation is not allowed

