

# **Gamechangers: Energy, Mobility and Transportation**

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# **POLICIES DRIVE MARKETS and TECHNOLOGICAL INNOVATIONS CAN CHANGE THE WORLD**

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**Targeted Policies and Technological Innovations Are Driving Fundamental Changes in the Electric Power Markets.**

**ELPC drives policies that shift markets and help align economics, which in combination with technological innovations, can achieve powerful environmental solutions.**

# THREE GAME CHANGING ELECTRICITY MARKET DRIVERS



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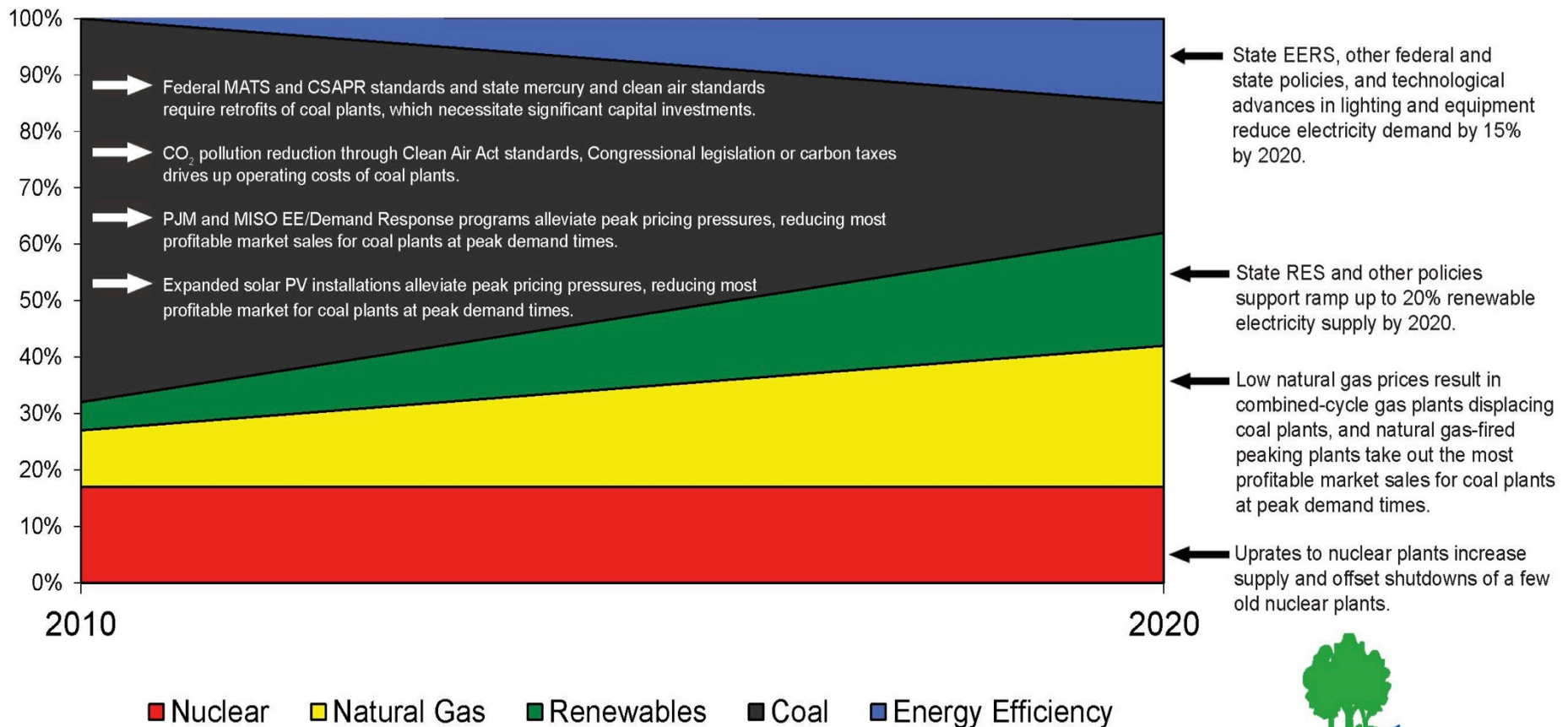
- 1. Energy Efficiency Is Driving Down Electricity Sales and Demand.**
- 2. Renewable Energy – Wind Power and Solar Energy + Storage – Are Zero Fuel Cost, Zero Pollution, Scalable, Decentralized Disruptive Technologies.**
- 3. Shale Gas Outcompetes Coal and Nuclear Power Generation.**

# MIDWEST ELECTRIC POWER MARKET TRANSFORMATION



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## Cleaning Up the Midwest's Electricity Sector: Developing Clean Energy and Reducing CO<sub>2</sub> Pollution



# ELECTRICITY SALES AND DEMAND ARE DECLINING DUE TO EFFICIENCY



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**Negative 0.5 - 1.0% annual is new reality (e.g., AEP, ComEd, DTE, Xcel) even though economy growing and utilities are adding new customers. Flat/declining sales reality has not been internalized by PUCs, policymakers, analysts, others.**

**Energy efficiency is working. All new and replacement lighting, appliances, HVAC, pumps, motors more EE.**

**PJM now forecasts flat load growth through 2032. Still too high. Saying negative would be totally disruptive.**

**LEDs, Solar + Storage coming in will reduce utilities' sales. Greatly offsets EVs – even with off-peak charging.**

# LED LIGHTING: RAPID MARKET PENETRATION



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## *Total U.S. LED Forecast Results*

<b>Year</b>	<b>2015</b>	<b>2020</b>	<b>2025</b>	<b>2030</b>	<b>Cumulative</b>
<b>LED Market Share</b>	11%	48%	72%	84%	-
<b>Site Electricity Savings (TWH)</b>	12	89	190	261	2216
<b>Site Electricity Savings (%)</b>	2%	15%	30%	40%	20%

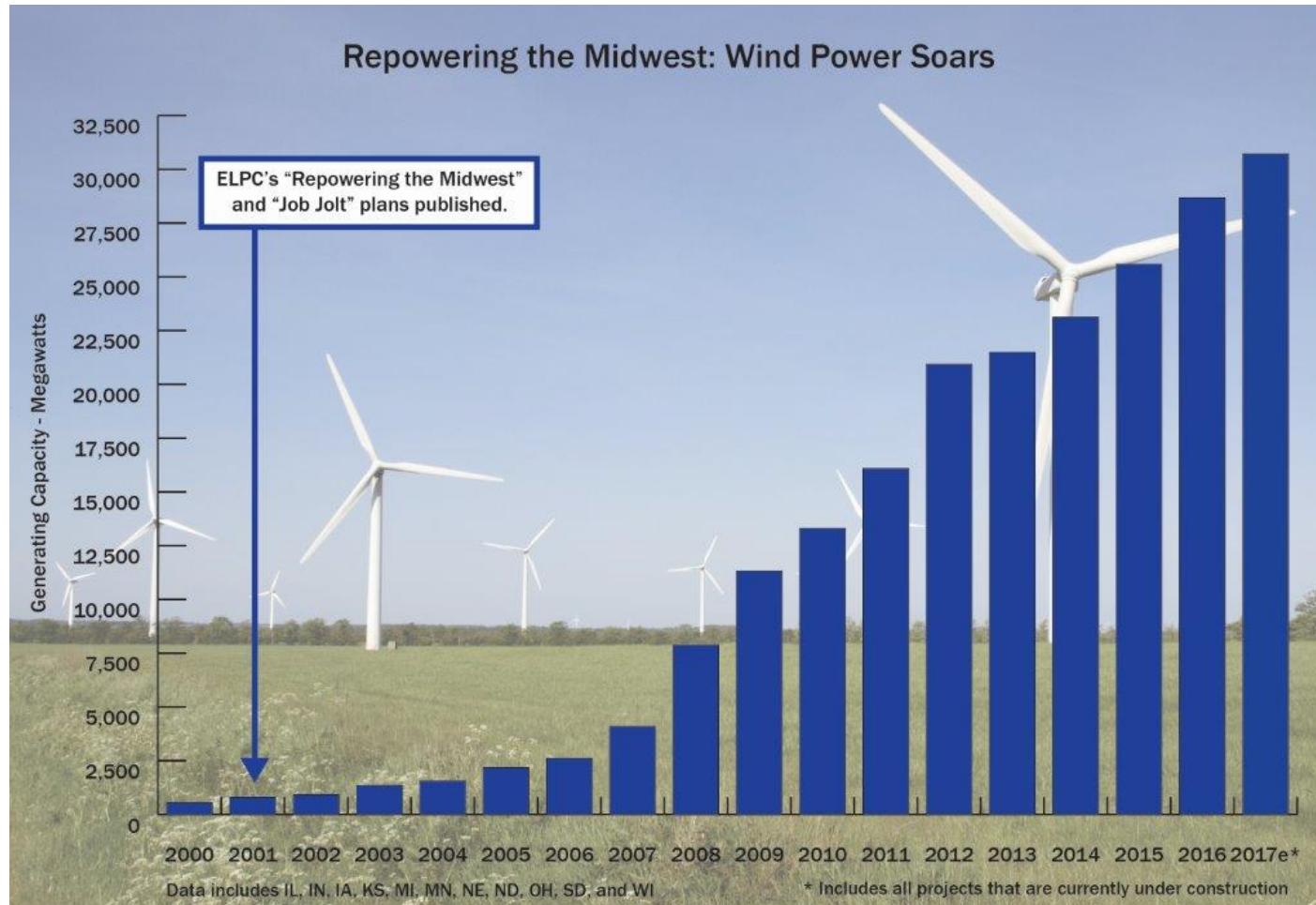
## *LED Market Penetration Forecast by Sector*

<b>Sector</b>	<b>2015</b>	<b>2020</b>	<b>2025</b>	<b>2030</b>
<b>Residential</b>	3%	33%	71%	83%
<b>Commercial</b>	8%	42%	69%	82%

# MIDWEST WIND POWER DEVELOPMENT SOARS AND MORE



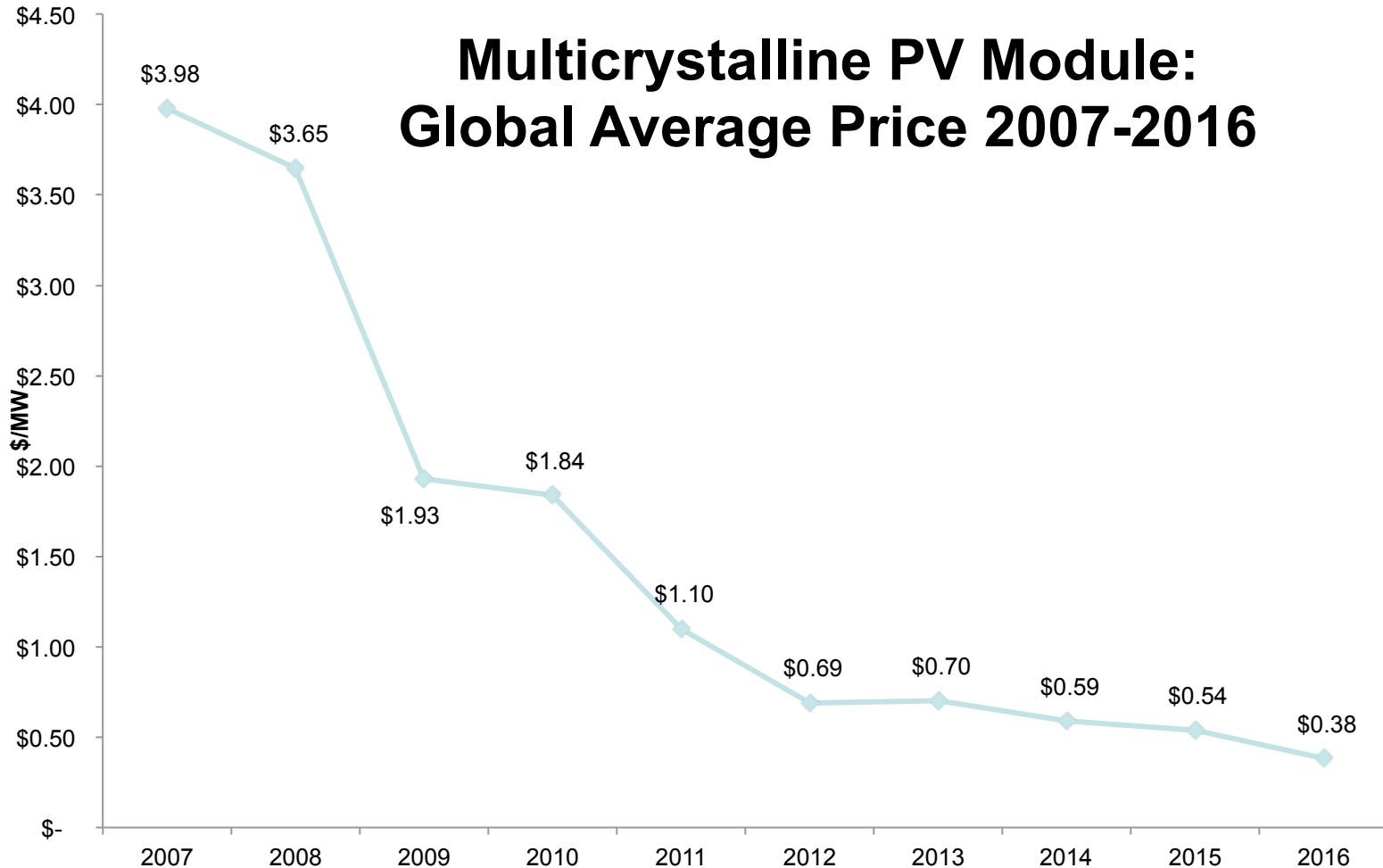
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# SOLAR PANEL PRICES < 40 ¢ per watt INSTALLED BIDS < (US) \$1 per watt



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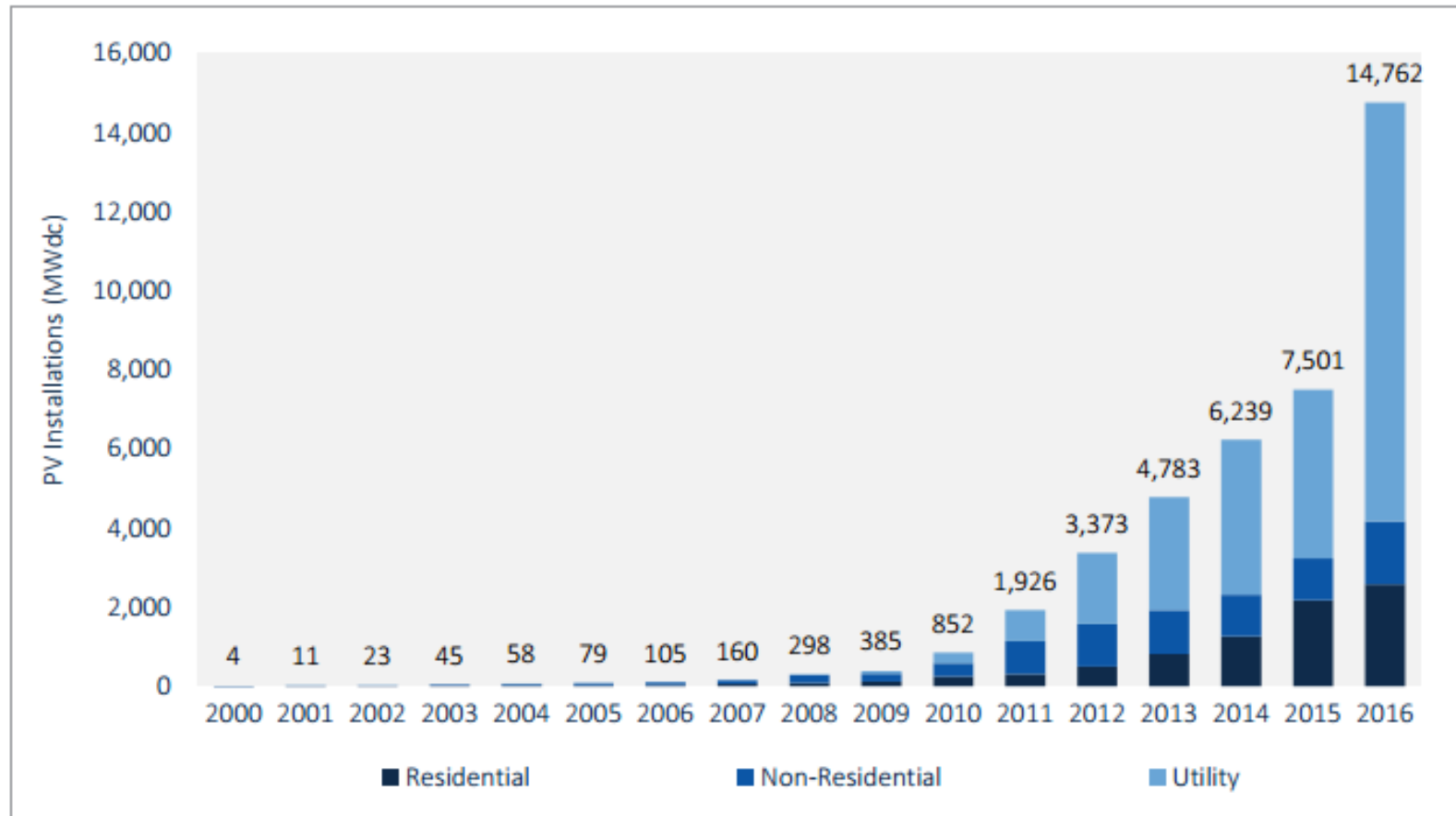


# U.S. SOLAR ENERGY DEVELOPMENT SOARS



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Figure 1.1 Annual U.S. Solar PV Installations, 2000-2016



# FOUR GAME CHANGING TRANSPORTATION MARKET DRIVERS



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- 1. EV Technologies Rapidly Improving**
- 2. Lithium Battery Pricing Falling Sharply and WTI Staying Below \$56 bbl**
- 3. Policy Drivers that Accelerate Progress: VW Settlement Funds, Electrify America Charging Infrastructure, E-School Buses**
- 4. Charge w/Solar & Wind, Rate Design**

# GAME CHANGER: EV TECHNOLOGY IMPROVING



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- 1. Range Rapidly Improving for Mass Market Priced Cars: Volt = 30 miles per charge, Bolt = 240 miles per charge**
- 2. Mass Market Pricing on Second Generation EVs**
- 3. Faster Charging and More Charging Stations**
- 4. Service Stations: New Business Line**

# GAME CHANGER: LITHIUM BATTERY PRICES FALLING



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- 1. Lithium Battery Costs Falling about 80% over Two Years**
- 2. Seems to Be World Supply Availability of Lithium as Other Technologies Get Room to Develop**
- 3. Changes Economics – A Lot!**

# GAME CHANGER: POLICY DRIVERS ACCELERATE EVs



- 1. VW Settlement Funds**
- 2. Electrify America – EV Charging Infrastructure**
- 3. E-School Buses - Visibility**
- 4. Opening Up Rest Areas for EV Charging**

- 1. Charge with Solar During the Day and Wind Power at Night So No Substituting “Carbon for Carbon”**
- 2. Off-Peak Pricing by Utilities for Home-Charging at Night – Fills Valleys**
- 3. What’s Competitive and What’s Monopoly Regulated?**
- 4. EVs = Battery Storage – Grid Support**



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