Track 1: Energy Generation

Note to presenter: When you advance to next slide, your presentation will appear.

Track Subtopics

- Ensuring Clean Energy Equity/Justice
- Electrifying Heating & Cooling
- Optimizing Solar Siting
- Advancing Distributed Energy Resources (DERs), including Energy Storage

CLIMATE FORWARD: ENERGY GENERATION (TRACK 1) POLICY IDEAS

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November 8, 2019

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Madison, WI

Break Out Group Topics

- **Break Out Group Topics below:**
-
- Ensuring Clean Energy Equity and Justice
- Electrifying Heating and Cooling
- Optimizing Solar Siting
- Advancing Distributed Energy Resources (DERs), including storage
- Other
-
- *Work these break out group topics into framing:*
- Balancing incremental policy steps and bold system redesign.
- Empowering local government in energy services and policy.

What we will discuss today?

- Policy Ideas: Highlight the state of the art in other states to address a changing energy system.
- Five break out group topics
- Framing short-term and long-term solutions
- Empowering local government
- An introduction to the new energy supply & demand paradigm driving the need for new energy policy.
- What economic opportunities spring from our ideas?
- Try to answer your questions.
- Organize robust discussions

Challenge and the Question (white paper)

The Challenge and the Question

Overarching questions:

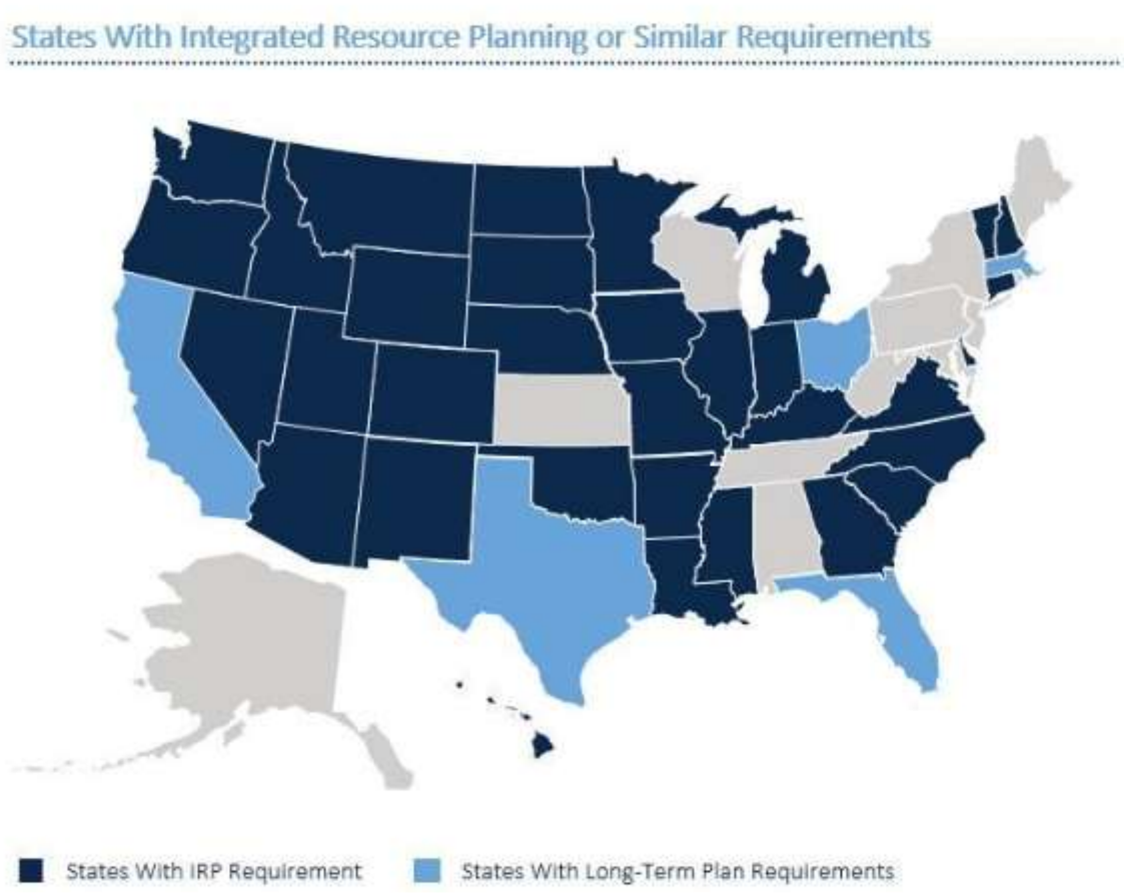
- What are the best short-term strategies for Wisconsin to reduce greenhouse gas emissions by increasing renewable energy generation in the state?
- What are the best long-term strategies for Wisconsin to reduce greenhouse gas emissions by increasing renewable energy generation in the state?

□What are best steps to take to achieve goals by 2030? By 2050?

What is the best way forward for WI energy system and necessary mitigation?

- Where do you want Wisconsin’s energy system to be in 10 years? Or 20 Years? Or longer?
- What is the best pathway to transition the Wisconsin energy system to the future?
- Can we construct a Wisconsin energy plan and update it every 5 years or so?
- What modeling is needed for systems solution to grid modernization and an advanced energy system?

Wisconsin is one of only ten states out of 50 without energy planning



State Distribution Planning

(Source: DOE)

	States with advanced practices					Other state approaches										
	California	Hawaii	Massachusetts	Minnesota	New York	D.C.	Florida	Illinois	Indiana	Maryland	Michigan	Ohio	Oregon	Pennsylvania	Rhode Island	Washington
Statutory requirement for long-term distribution plans or grid modernization plans[a]	✓			✓					✓							
Commission requirement for long-term distribution plans or grid modernization plans[a]		✓	✓		✓					✓	✓					
No planning requirements yet, but proceeding underway or planned						✓							✓		✓	✓
Voluntary filing of grid modernization plans								✓				✓		✓		
Non-wires alternatives analysis and procurement requirements	✓				✓										✓	
Hosting capacity analysis requirements	✓	✓		✓	✓											
Locational net benefits analysis required	✓				✓											
Smart grid plans required													✓			
Required reporting on poor-performing circuits and improvement plans							✓	✓				✓		✓	✓	
Storm hardening requirements							✓			✓						
Investigation into DER markets		✓														

(a) For one or more utilities.

What is the energy future?

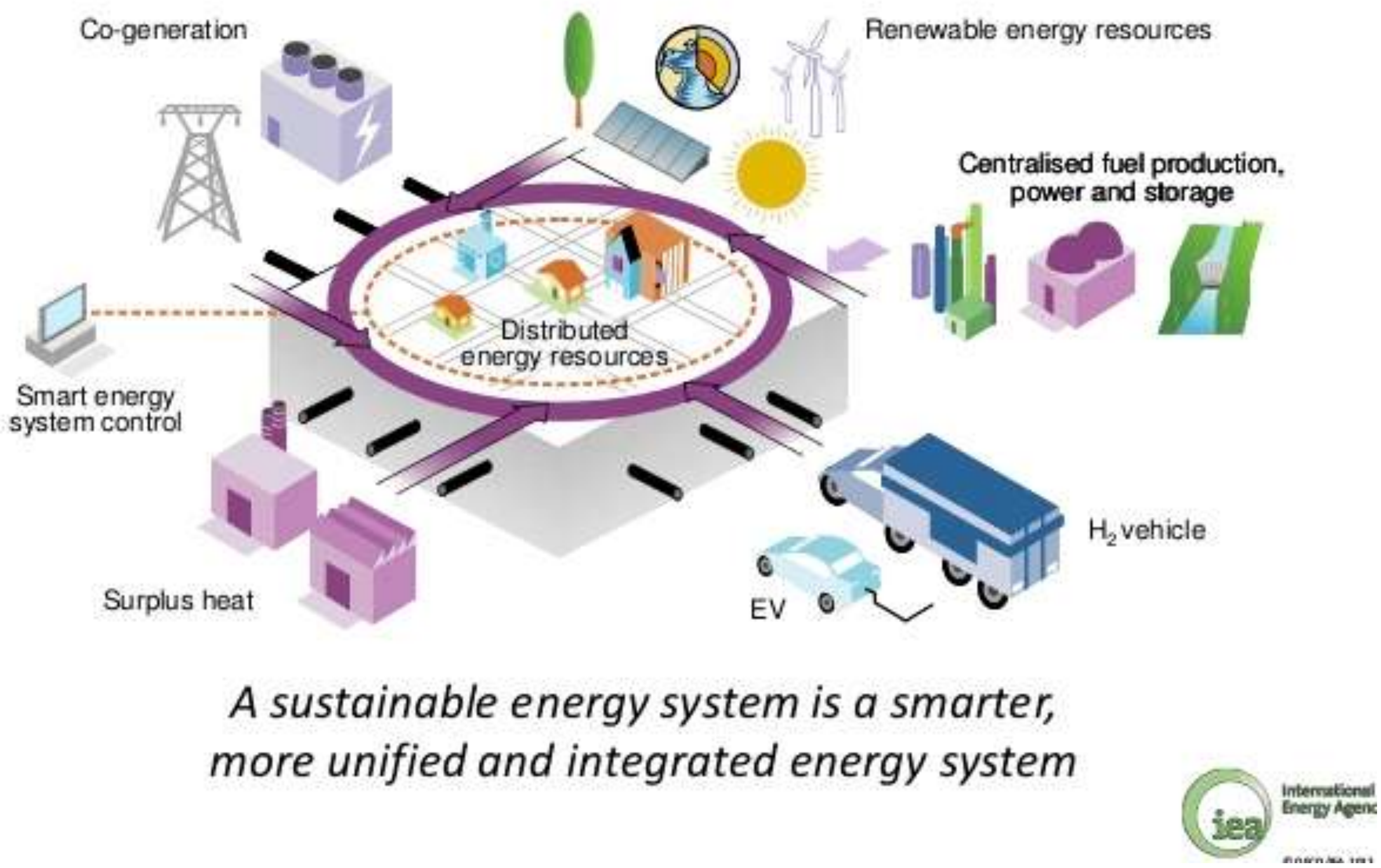
- **Flat, volumetric tariffs "are no longer adequate," the MIT report says, and goes on to blame them for "inefficient investment, consumption, and operational decisions." (The Future of the Electric Grid, 2011)**

- **Grid modernization will be the backbone to advanced energy and consumer choice.**

- **Active Energy Management:** Buying energy smarter. Using energy efficiently. Operating sustainably. (MIT: What are fair, equitable, and efficient tariffs in the presence of DERs, 2018).

Active energy management is a holistic view of the strategies, data and resources needed to reduce consumption, drive innovation and maximize savings.

DERs allow for a paradigm shift



Growing Electricity Customer Options (DERs = New supply & demand paradigm)

- **Buy it**: the legacy grid & utility are no longer the only option
- **Make it**: first challenge to status quo with solar PV, wind and biogas distributed generation options
- **Eliminate it**: energy efficiency or negawatts are raising the bar with innovative solutions and goals to reduce or eliminate waste.
- **Store it**: (energy storage) emerging disruptive to change to address multiple grid services, intermittent renewables,& potentially **dispatch it** yourself
- **Shift it**: demand response or demand flexibility is evolving from a traditional solution to a flexibility tool complemented by other DERs
- **Manage it**: Microgrids, virtual power plants, smart grid, home & business management software, algorithms to help prosumer buy and sell energy when the market is favorable. New business model (**aggregate it**)
- **Sell it or share it**: the advent of transactive energy and blockchain technology advances the concept of a new energy value proposition
- **Reduce it**: No investments in overbuilt generation and fewer system losses.

What is flexibility?

- **Ramp** – the ability to respond rapidly and over sustained periods to changes in load or generation.
- **Over-generation** – the grid needs to be able to absorb or shift excess generation.
- **Frequency** – the grid needs to be keep generation and load in balance at all times.
- **Voltage** – maintain voltage within acceptable limits. While the other flexibility needs are required at a larger system level, voltage is a local requirement and must be managed at a circuit level.
- *Flexible resources can be used to reduce system peaks and flatten net load*

Shift It: Demand Flexibility Saves Both Grid Costs and Customers Money

- Demand flexibility is how DER growth and integration makes demand response a more valuable tool in the tool kit. See the study, “The Economics of Demand Flexibility: How “Flexiwatts” Create Quantifiable Value for Customers and the Grid” authored by RMI.
- **In the residential sector alone, widespread implementation of demand flexibility can save 10–15% of potential grid costs, and customers can cut their electric bills 10–40% with rates and technologies that exist today.**
- Flexiwatts means using communication and control technology to shift electricity use across hours of the day. The premise is to use smart technology to move things like air conditioning, water heating, and electric vehicle charging to times when load is lower and electricity is cheaper. Devices now have the capability to control those functions and can be programmed to know the lower price periods of the day.
- See The Economics of Demand Flexibility: http://www.rmi.org/electricity_demand_flexibility

Indiana could save $2.3B with DER

(source: Indiana Advanced Energy Economy/ AEE)

- Using three different demand management market strategies: curtailing commercial and industrial electricity demand; installing more smart thermostats across Indiana's residential sector; and deploying energy storage technologies.
- Examining the impact of these strategies under scenarios representative of avoided costs in Indiana, the analysis shows that net benefits for electricity ratepayers (total savings minus costs) range from $448 million to to $2.3 billion over 10 years.
- Policy Implication: **"a combination of demand reduction strategies could avoid or defer the need for new power plants , transmission lines, and distribution infrastructure."**

Performance Based Rates: Principles

Principles for Performance Incentive Mechanisms

PRINCIPLE 1: A performance incentive mechanism can be considered when the utility lack an incentive (or has a disincentive) to better align utility performance with the public interes and there is evidence of underperformance or evidence that improved performance wil deliver incremental benefits.

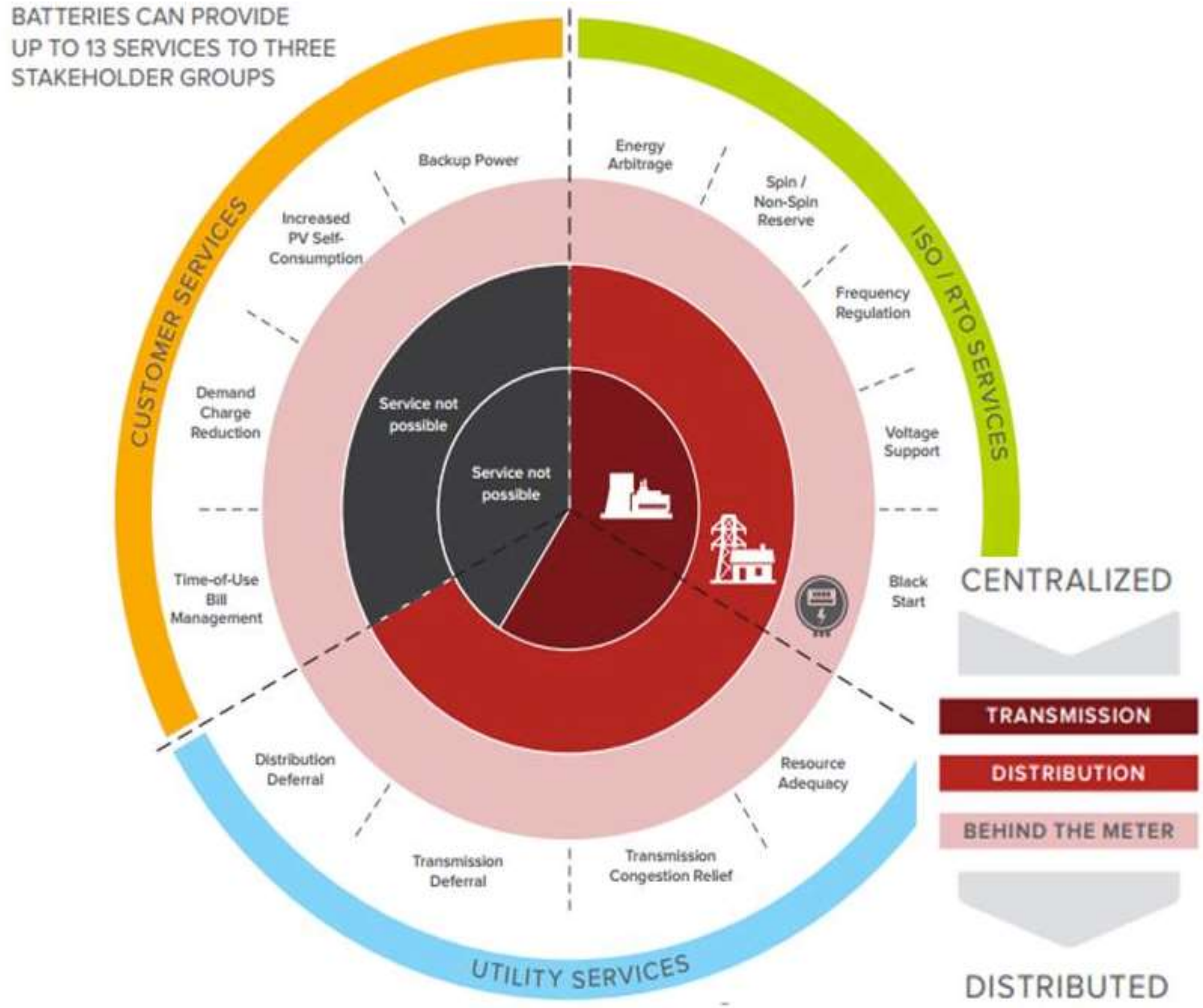
PRINCIPLE 2: Incentives should be designed to enable a comparison of the cost of achievin the target to the potential quantifiable and cash benefits.

PRINCIPLE 3: Incentives should be designed to maximize customers' share of tota quantifiable, verifiable net benefits. Consideration will be given to the inherent risks anc fairness of allocation of both cash and non-cash system, customer, and societal benefits.

PRINCIPLE 4: An incentive should offer the utility no more than necessary to align utilit performance with the public interest.

PRINCIPLE 5: The utility should be offered the same incentive for the same benefit. N action should be rewarded more than an alternative action that produces the same benefit.

Battery Storage 13 Services



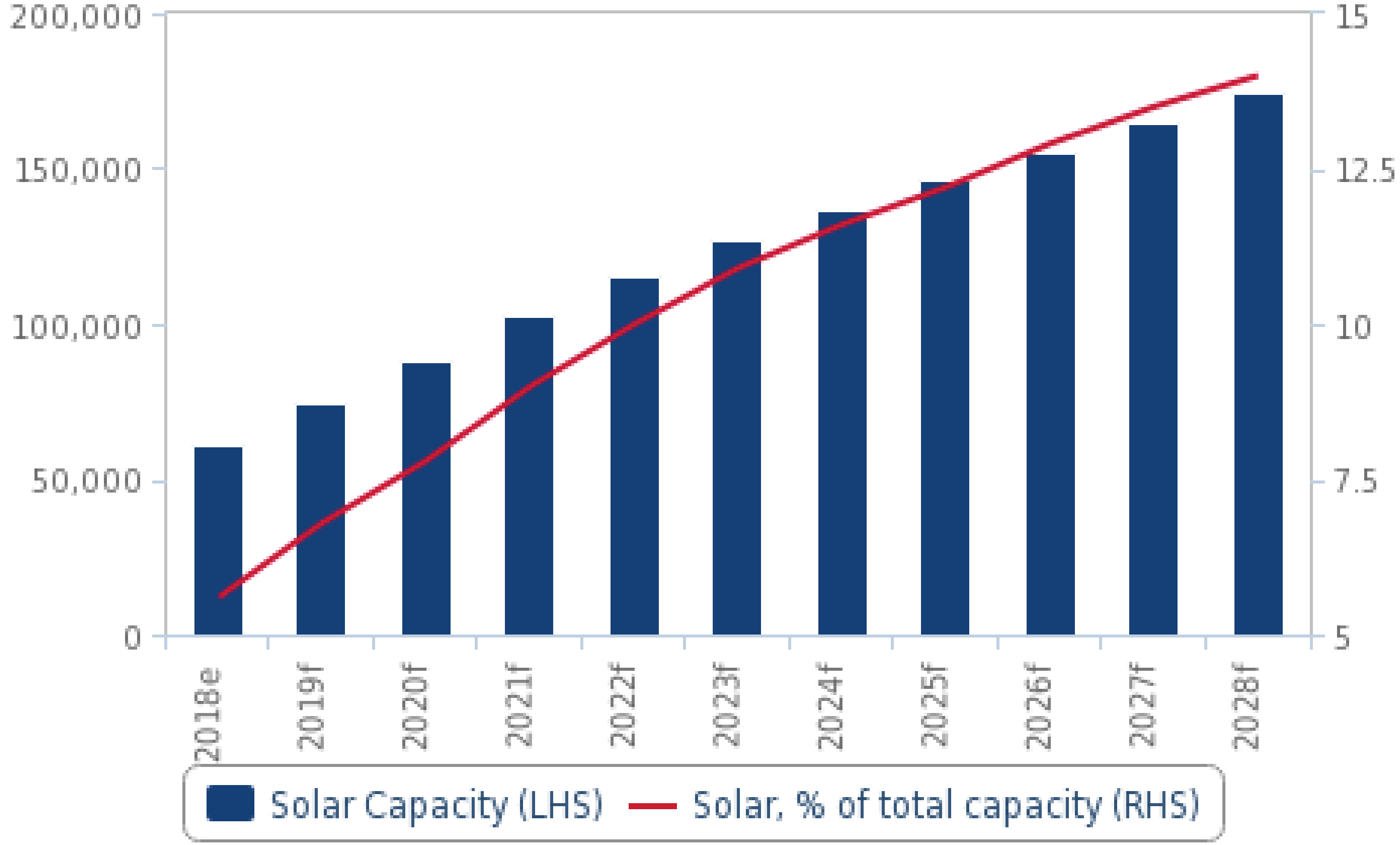
Good News on Solar: Issues?

- The amount of renewable generation in the MISO interconnection queue is remarkable: solar: 6,000 MW (compared to 95 MW today, although another 500+ MW is also under construction); wind: 1,196 MW (748 MW today); and battery storage: 421.5 MW (0 MW today).

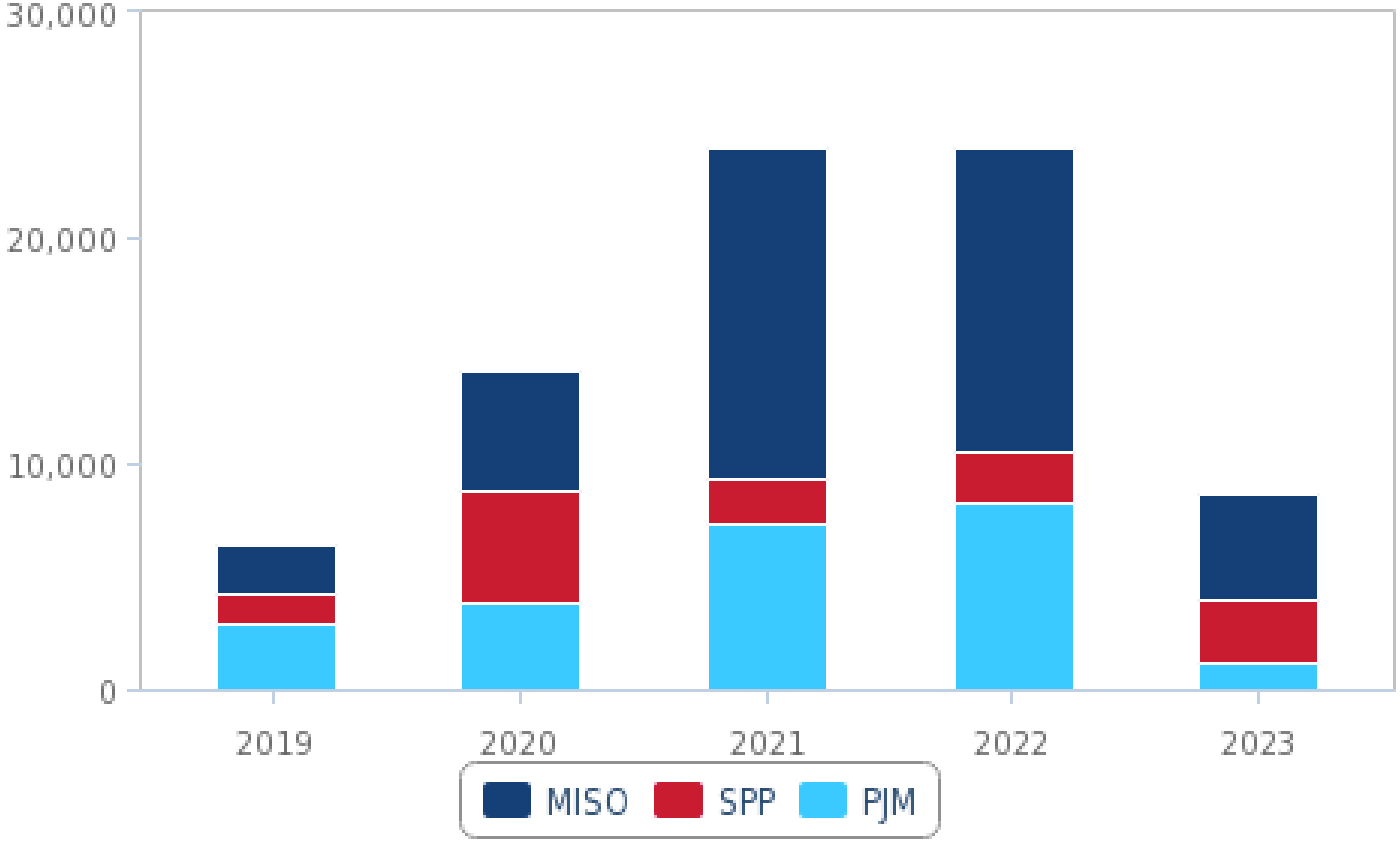
- What does this mean for renewable energy development in Wisconsin; what issues does it raise?

30,000 megawatts of Utility Solar in MISO as of May 2019 (Not all will be approved)

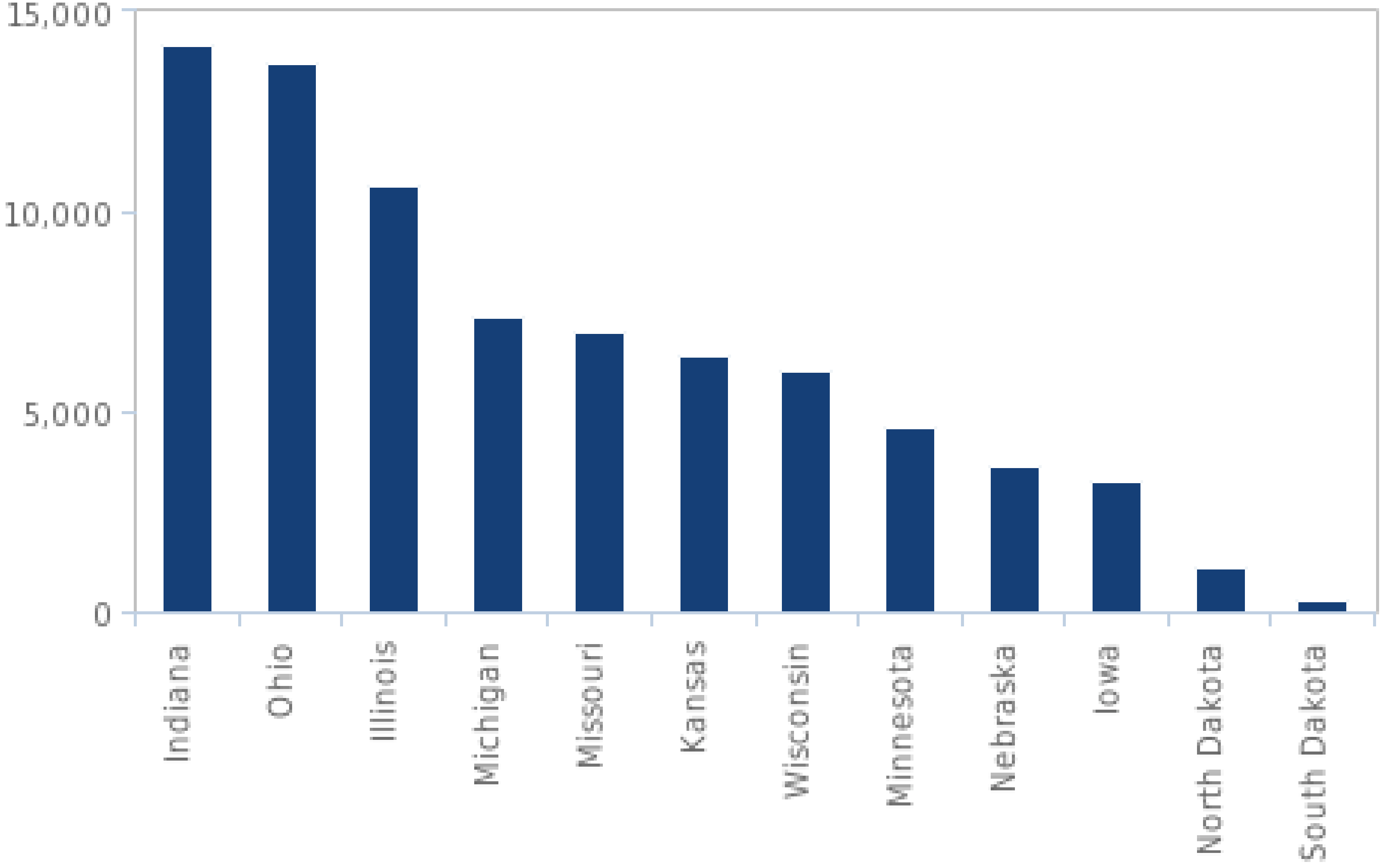
2018-2028 Projected Midwest Solar Growth



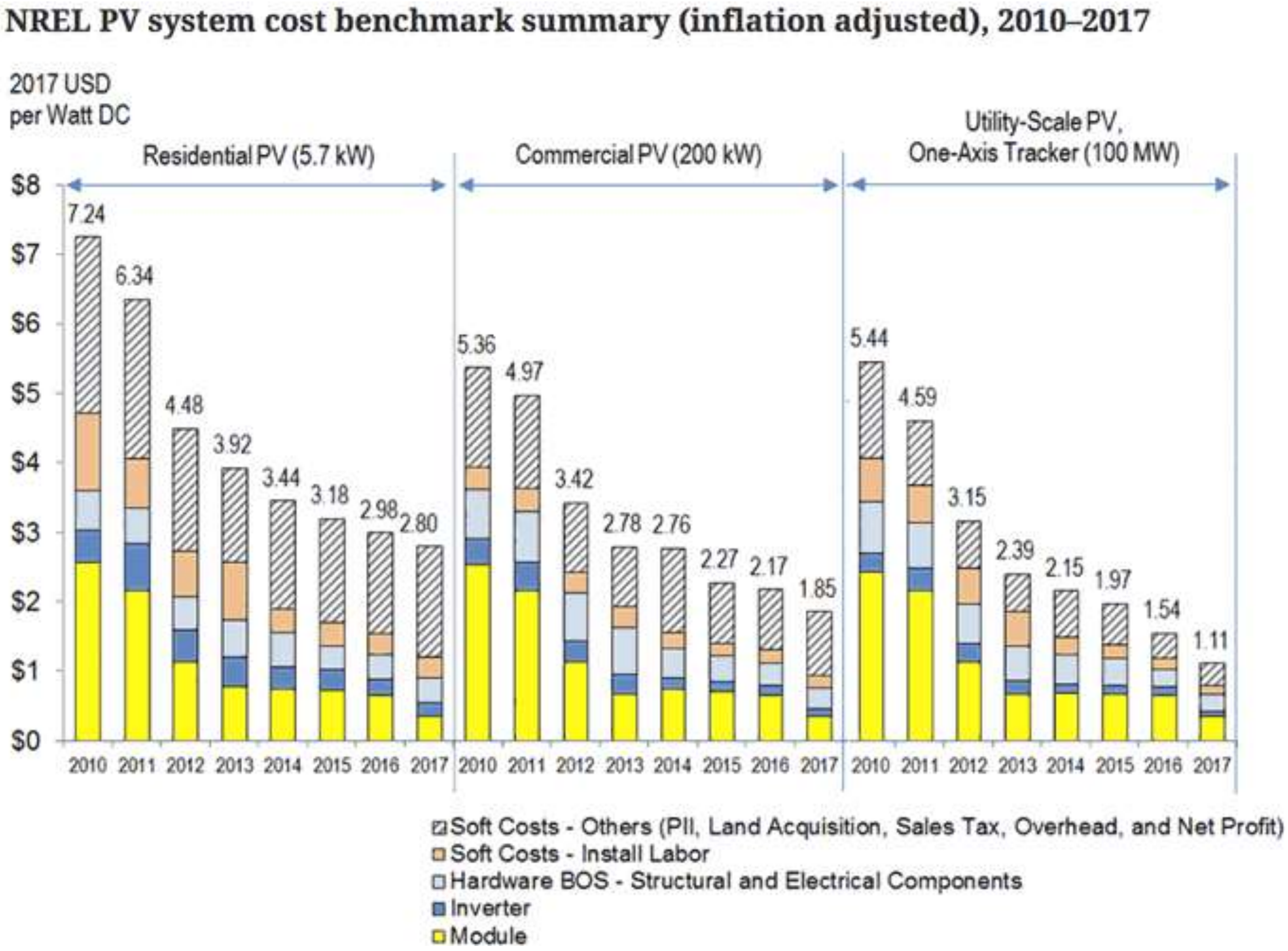
Midwest ISO Projected Solar Growth



State-by-State Projected Solar Growth



PV System Cost Declines

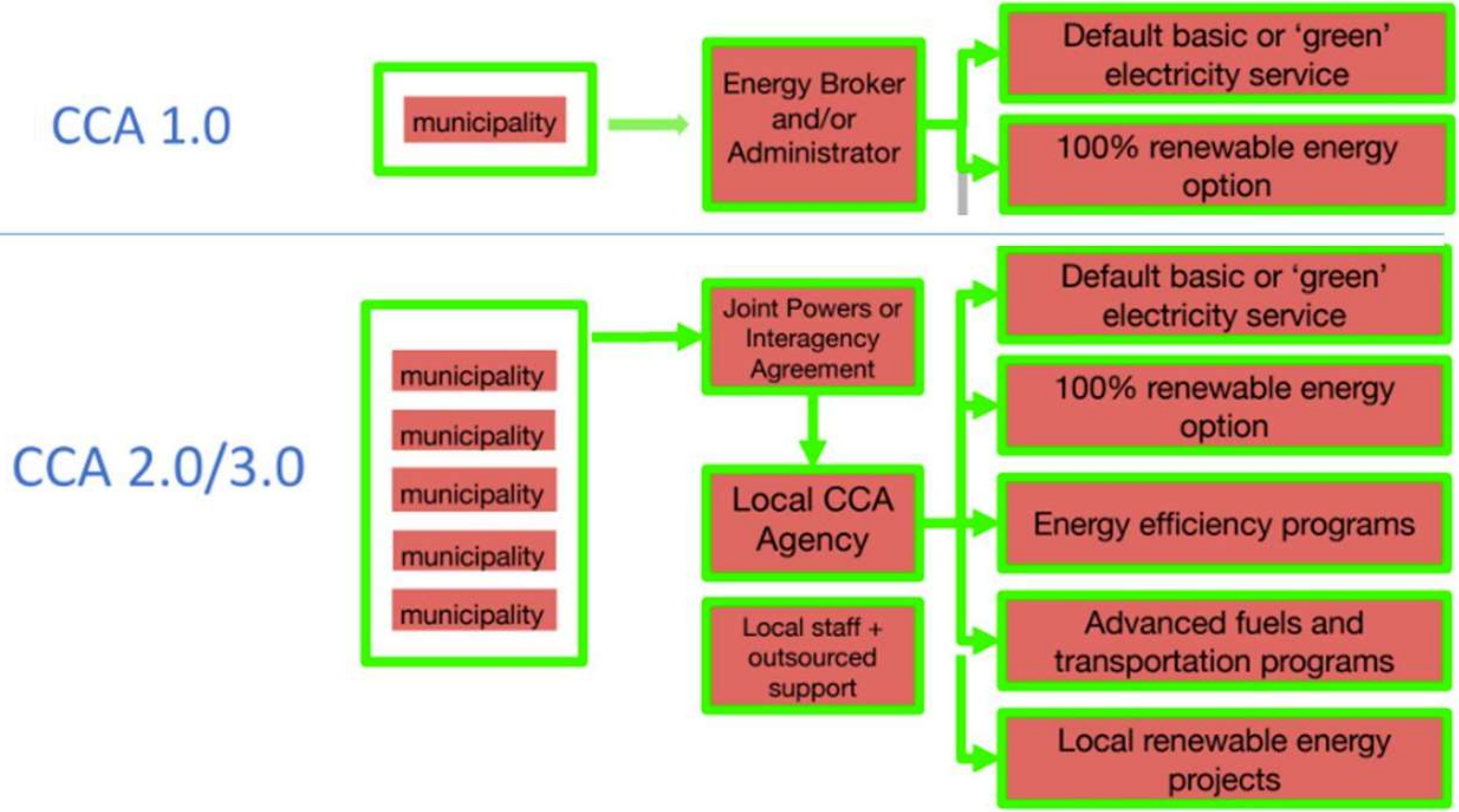


True Value of Rooftop Solar

(Source: Environment America)

Benefit Category		Benefit
Grid	Energy	Avoided electricity generation
		Reduced line losses
		Market price response
	Capacity and Grid Investments	Avoided capacity investment
		Avoided transmission and distribution investment
		Reduced need for grid support services
	Risk and Reliability Benefits	Reduced exposure to price volatility
		Improved grid resiliency and reliability
	Compliance	Reduced environmental compliance costs
Societal	Environment	Avoided greenhouse gas emissions
		Avoided air pollution
		Health benefits
		Avoided fossil fuel lifecycle costs
	Economy	Local jobs and businesses

Community Choice Aggregation



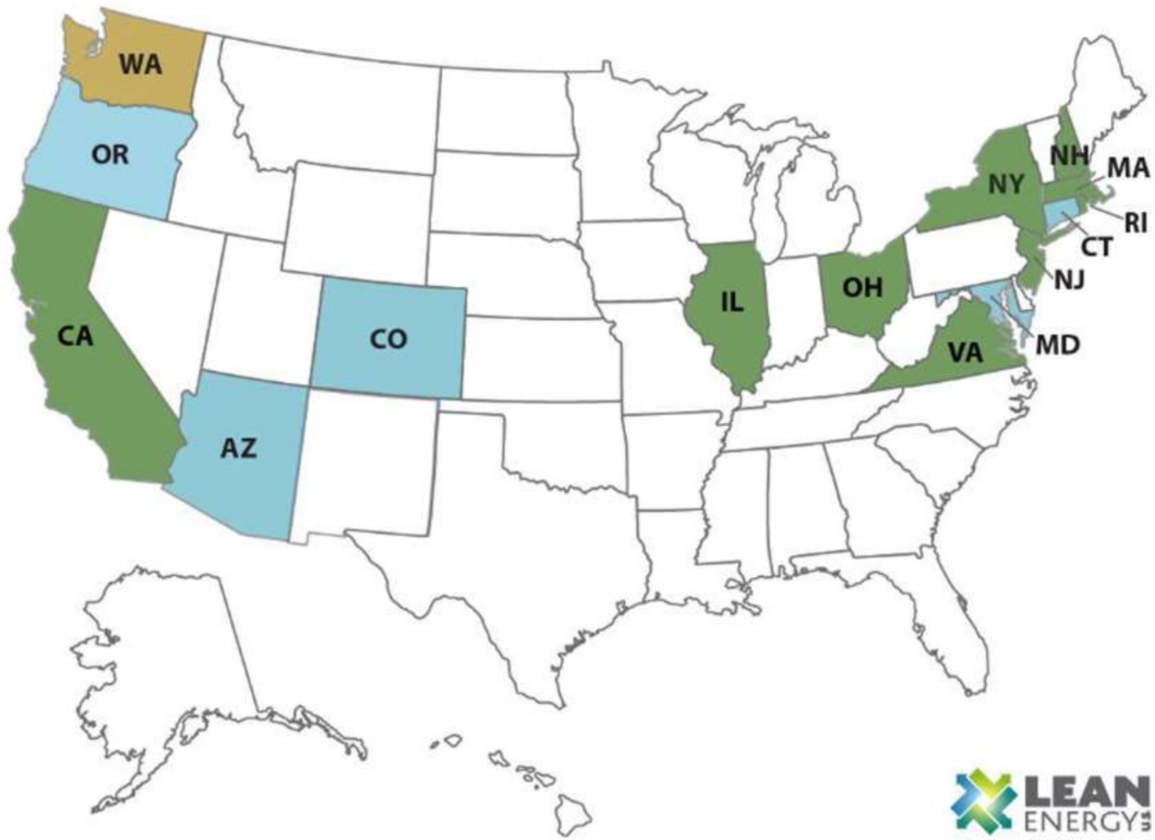
State Community Choice Aggregation

Authorized in 9 States:
- California
- Illinois
- Massachusetts
- New Hampshire*
- New Jersey
- New York
- Ohio
- Rhode Island
- Virginia*

Actively Investigating:
- Arizona
- Colorado
- Connecticut
- Maryland
- Oregon

Watch List/Potential:
- Washington

* Not yet implemented



LEAN ENERGY US

Source: LEAN Energy U.S.
Sept. 2019

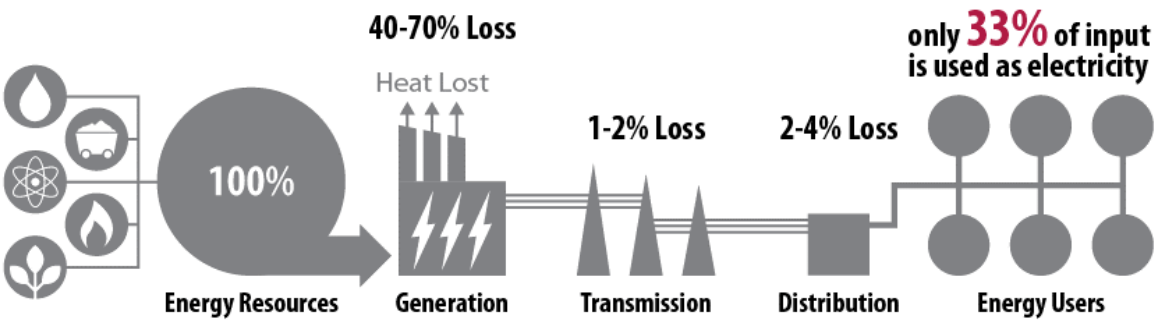
What is a microgrid?

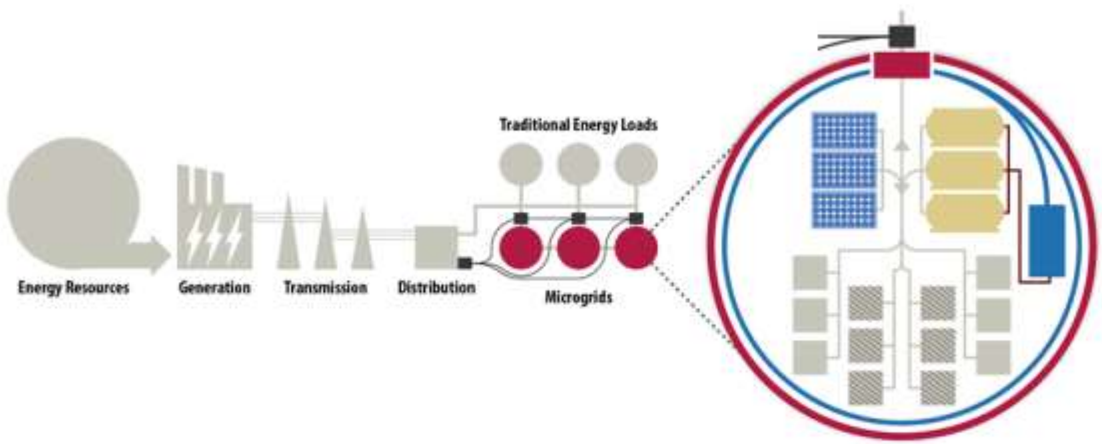
What is a Microgrid?

"A **microgrid** is a group of interconnected loads and distributed energy resources within clearly defined electrical boundaries that acts as a single controllable entity with respect to the grid. A microgrid can connect and disconnect from the grid to enable it to operate in both grid-connected or island mode."

Microgrid Exchange Group, October 2010

Microgrids & Advanced Distribution Networks

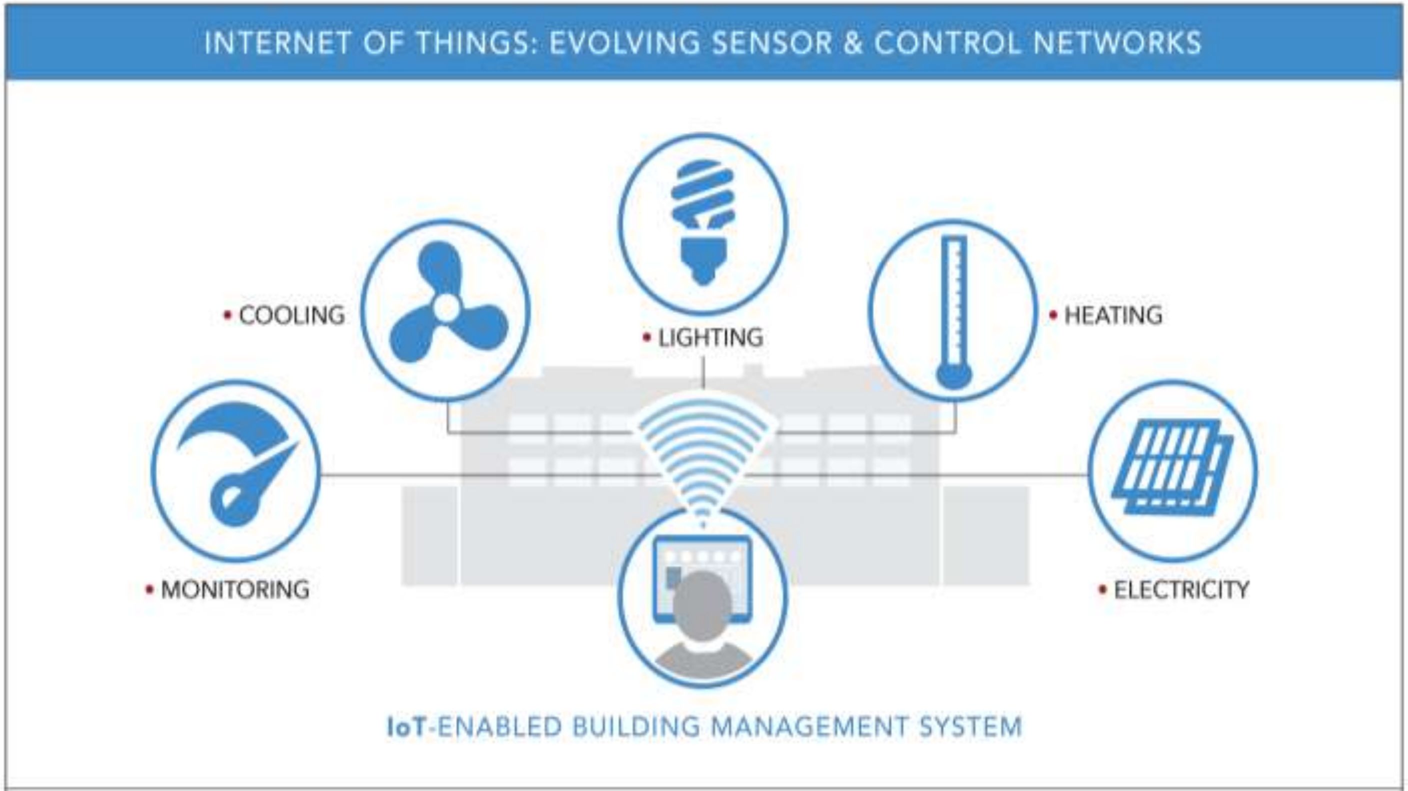




- Enables greater efficiency and resiliency.
- Helps address $100B in business losses due to power disruptions.
- Deployed at hospitals, military bases, factories, more
- Offers new products and supply chains for Wisconsin’s electrical equipment manufacturers.

Sensors & Controls = IoT

(Source: American Jobs Project)



Sensors and controls are rapidly evolving from physical, wire-based systems to wireless, internet-enabled networks. This "Internet of Things" (IoT) can facilitate robust data collection and analytics, digital control and automation, and telecommunications.

Demand Flexibility Could Save Texas $1.9 Billion Annually (Source: Rocky Mountain Institute/RMI)

- A new study by the Rocky Mountain Institute models demand flexibility options such smart water heaters, ceramic brick heat storage, grid-responsive electric vehicles, & others to achieve system-wide savings into the billions and meaningful reduction of Co2 emissions.
- Solutions such as water heaters, electric vehicles, and plug loads only require relative small investments in communications technologies to enable flexibility (aka smart grid investments).

➢ Report can be found here: https://www.rmi.org/wp-content/uploads/2018/02/Insight_Brief_Demand_Flexibility_2018.pdf