New(er) Power on the Farm: Wind, Solar, Methane, Biomass

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Goals

- Review the various renewable energy options available to our farm and ag accounts.
- We will examine the benefits and challenges of the use of wind, methane, solar and biomass on the farm.
- What are the risk management considerations and insurance issues for these energy options?
- Finally, are their other issues and potential losses that should be of a concern for us and our farmers

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Why Is Farm/Ag A Target

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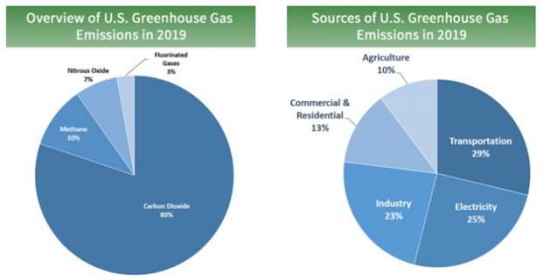
Overview if Green House Gases (GHG)



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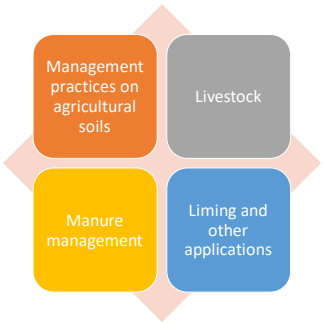
Sources



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DRIVERS FOR THESE CHANGES

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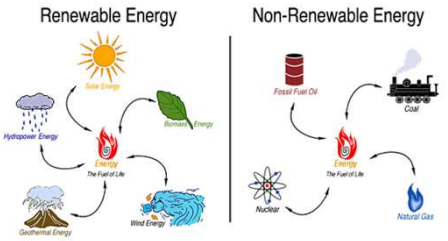
Renewable Energy



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Impetus Behind These Energy Options

- Politics
- Environmental pressures
- Technology
- Demographics
- Resources
- Global Economy

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Can We Separate

- Politics from Environmental Pressures ?
- Majorities of Americans say the federal government is doing too little for key aspects of the environment, from protecting water or air quality to reducing the effects of climate change.
- Most believe the United States should focus on developing alternative sources of energy over expansion of fossil fuel sources
  - Pew Research Center, Nov. 2019

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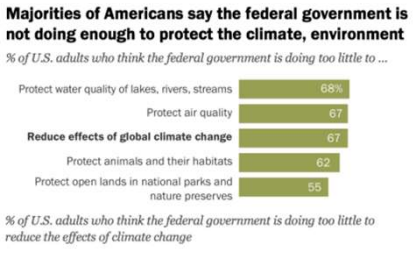
Think



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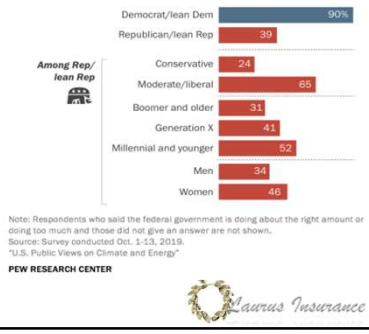
Think A Bit More



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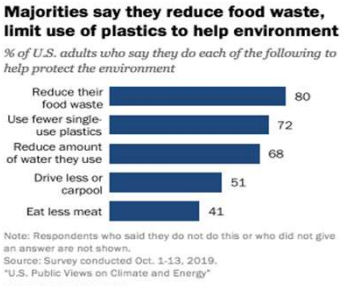
Food Waste and the Environment



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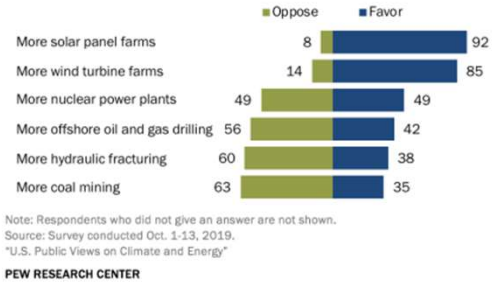
Most Americans favor expanding solar or wind power; half or fewer support expanding fossil fuels

% of U.S. adults who say they ____ expanding each energy source



Note: Respondents who did not give an answer are not shown.
Source: Survey conducted Oct. 1-13, 2019.
"U.S. Public Views on Climate and Energy"

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Technology

- Not necessarily a driver of energy change
- Rather it views energy challenges as opportunities to improve the ways and means of how we approach energy and potential climate change issues

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Technology - Low-Methane Cows

- **The Challenge**
- Methane is 85 times more heat-trapping than CO_2, and grazing animals create a third of emissions. While cow farts get all the jokes, 95 percent of methane leakage actually comes out the front end, in belches.
- **The Tech**
- U.K.-based Zelp has invented a halter that rests loosely over a cow's nostrils, monitors methane exhaust, and zaps it with a catalyst, creating water and less-harmful CO_2. The device can lower bovine emissions by half.
- **The Potential**
- In the U.S. alone, there are more than 90 million head of cattle. Wearable technology can help ranchers track and claim their reduced emissions, while also giving them valuable data on the health of their herds.

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Demographics

- Age
- Location
- Incomes
- All of these imp[act how various citizens view the potential and challenges of climate change---and---what they want to do about it

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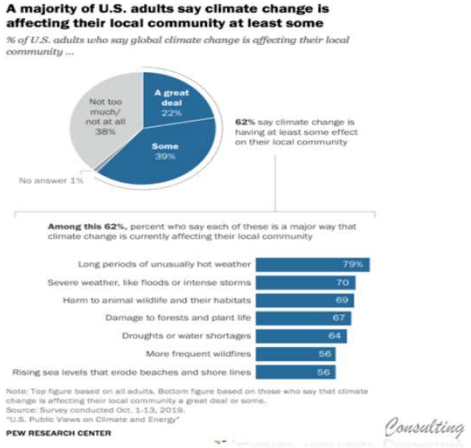

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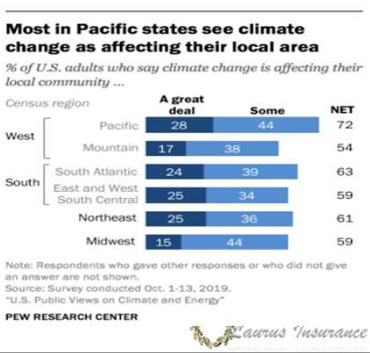
Pacific States



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Western States

Americans living in Western states are particularly likely to report increased wildfire frequency, droughts as major local effects of climate change

Among U.S. adults in each region who say climate change is affecting their local community at least some, % who say each of the following is a major way climate change is affecting their local community

CENSUS REGION		Long periods of unusually hot weather	More frequent wildfires	Droughts or water shortages	Rising sea levels that erode beaches
West	Pacific	78	83	76	62
	Mountain	85	78	85	38
South	South Atlantic	85	49	67	64
	East and West South Central	86	56	69	53
Northeast		76	46	50	64
Midwest		66	40	48	46

Note: Based on those who say that climate change is affecting their local community a great deal or some. Respondents who gave other responses or who did not give an answer are not shown.
Source: Survey conducted Oct. 1-13, 2019.
"U.S. Public Views on Climate and Energy"

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Global Economy

- The growth of the world's capacity to generate electricity from solar panels, wind turbines and other renewable technologies is on course to accelerate over the coming years, with 2021 expected to set a fresh all-time record for new installations
- By 2026, global renewable electricity capacity is forecast to rise more than 60% from 2020 levels to over 4 800 GW – equivalent to the current total global power capacity of fossil fuels and nuclear combined.
- Renewables are set to account for almost 95% of the increase in global power capacity through 2026, with solar PV alone providing more than half. The amount of renewable capacity added over the period of 2021 to 2026 is expected to be 50% higher than from 2015 to 2020.

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Overall Pressures

- Climate change
- Demand for more and cleaner electric
- Renewable vs. non-renewable energy options, based on…
  - Public perceptions
  - Renewable portfolio worries
  - Improving technology
  - Financial and tax incentives
  - Job creation

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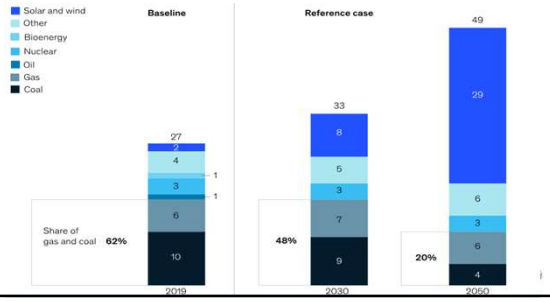
Future Electrical Power Generation – McKinsey 2021 Report

Coal and gas still dominate power generation—and will likely continue to do so through 2030.

Global power generation mix, PWh[1]



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Why Change Is Happening Now – EU & US

- Power-generation fleet is ageing; many nuclear and thermal power plants are nearing the end of their lifetime and need to be replaced or refurbished
- First generation of wind turbines is also reaching the end of its operational lifetime and will soon be decommissioned
- Coal remains the backbone of power generation in several countries; this is no longer consistent with environmental objectives
- Solar and wind generate highly variable amounts of energy, which pose threats to system stability and reliability.

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Wind Power & Ag

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Wind Power

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U.S. utility-scale electricity generation by source, amount, and share of total in 2020

Energy source	Billion kWh	Share of total
Total - all sources	4,007	
Fossil fuels (total)	2,427	60.6%
Natural gas	1,624	40.5%
Coal	773	19.3%
Petroleum (total)	17	0.4%
Petroleum liquids	10	0.2%
Petroleum coke	8	0.2%
Other gases[3]	11	0.3%
Nuclear	790	19.7%
Renewables (total)	792	19.8%

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U.S. utility-scale electricity generation by source, amount, and share of total in 2020

Renewables (total)	792	19.8%
Wind	338	8.4%
Hydropower	291	7.3%
Solar (total)	91	2.3%
Photovoltaic	88	2.2%
Solar thermal	3	0.1%
Biomass (total)	56	1.4%
Wood	37	0.9%
Landfill gas	10	0.3%
Municipal solid waste (biogenic)	6	0.2%
Other biomass waste	2	0.1%
Geothermal	17	0.4%
Pumped storage hydropower[4]	-5	-0.1%
Other sources[5]	13	0.3%

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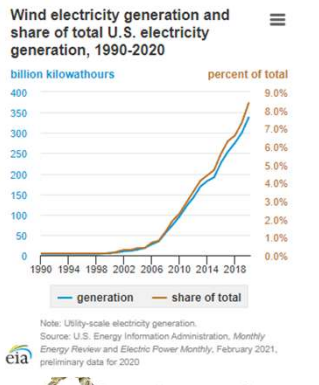
Wind Power



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Some Concerns

- Bird strikes
- Flicker effect
- Noise
- Wake effects
- End of life disposal

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Wind Generators

- Farm sized generators
  - Sized 1 – 90 kW
  - 10-50 kW is average
  - 5-15 kW (homes)
- 10 kW - $50,000 (power average home)
  - Average U.S. home 12,000 kw
  - Prices have dropped as low as $30,000.
- 11 mph wind – low minimum
- 1 acre unobstructed
- Sturdy tower vs. antenna tower

1kW=1000 watts
(10) 100W lightbulbs

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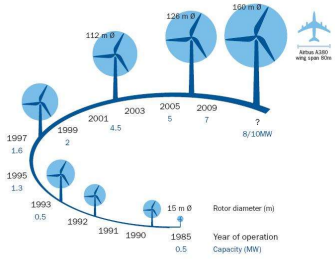
Practical Limitations?



There are practical limitations on how large individual turbines can be constructed. At a certain point, the excess costs of manufacturing, transport and construction exceed the incremental benefit of MW output. Also, the largest turbines are only effective in areas of high wind speeds (largely offshore).

Source: CleanTechnica

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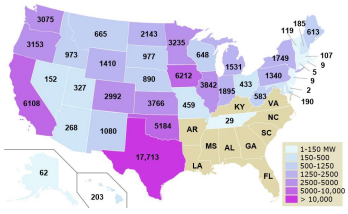
Wind Does Not Work Everywhere…



Map illustrating installed wind generating capacity for U.S. states

Source: Wikipedia

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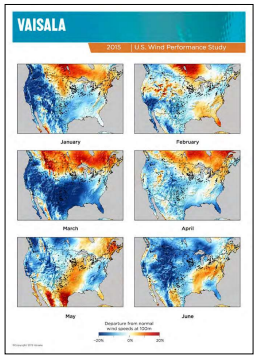

To say that wind speeds can be unpredictable over a given month would be an understatement..

Source: GCube/Vaisala

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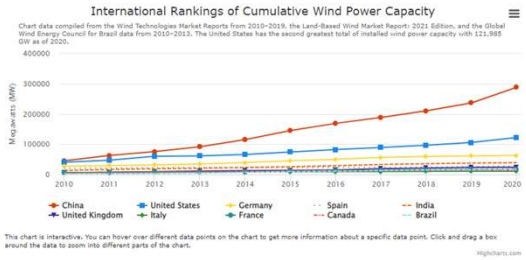
International Wind



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Wind Power - Hazards

- Fire
- Wind
- Impact
- Natural Hazards
- Electrical Breakdown
- Mechanical Breakdown
- Collapse
- Human Element

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Wind Generator Considerations

- Common problems
  - Lightning damage to batteries and other electronic equipment
  - Arcing damage
  - Wind blowing down the tower
- Sell power back to the grid?
- What perils do you allow?
- Does your policy language support insured's exposure?

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Wind Energy Claims

- Fires
  - Lightning
  - Electrical fault
  - Transformer fires
  - Wildfires (remote locations exacerbate)

750 kW wind turbine with generator and gearbox after fire event

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Wind Energy Claims

- Blade failure
- Gearbox failure
- Foundation cracking
- Natural disasters
- Nuisance liability claims

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Insuring Wind Turbines

- Some insurers will not cover free-standing structures, such as a wind turbine, under a homeowners/farmowners policy
- It may be necessary to purchase additional coverage
  - Property coverage generally includes coverage for property damage resulting from windstorms, lightning, ice buildup, and fire
  - Purchased limit should be sufficient to cover the cost of replacing the wind installation

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Application of Wind On Farms

- Been used for years to pump water
- Irrigation
- Lighting
- Steady income from leases

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Solar

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Solar

aka photovoltaic system, solar PV power system, or PV system

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1. Solar Star, California

Solar Star, California

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5 Top Solar Farms in the US

- Solar Star
- Topaz Solar Farm
- Ivanpah Solar
- Agua Caliente Solar Project
- The Crescent Dunes Solar Energy Project

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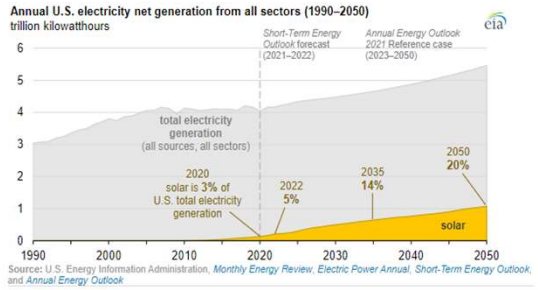
US Electricity Net Generation



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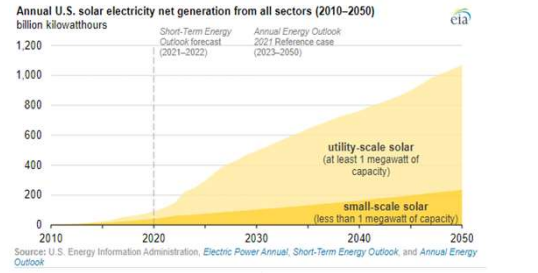
Small Scale vs. Utility Scale



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Solar Uses on Farms

- Agricultural irrigation
- Refrigeration
- Drying
- Electrical power source to run just about anything

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Solar Farm Applications

Solar-Powered Electric Fencing

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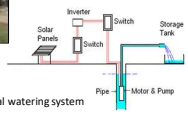
Solar Farm Applications

Animal watering



- 650 watt solar animal watering system
- 2400 gallons/day
- 250 foot deep well
- Total system cost = $6K

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Solar Farm Applications

1000 kW Solar System—Elkhorn Dairy, Visalia, CA

- 5 Acres of Solar Panels
- Provides 80% of all electricity needs on the farm
- Total installation cost—$8.5M

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Elkhorn Dairy Video

- https://youtu.be/IQD7oXacWgU

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Solar Thermal Water Heating Farm Applications

Roof mounted solar collectors on the garage roof (making hot water).

- Collectors are "evacuated tube solar collector" types that absorb the sun's energy and convert it into heat.
- Heated pipes (blue verticals) conduct the heat from the solar tubes up to the "header" (horizontal white strip at the top) that gets water from a storage tank inside the house.
- Water is slowly circulated through the header using a small electric motor powered pump and sent to a hot water storage tank.

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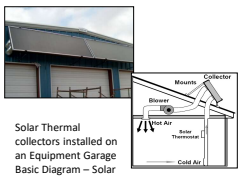
Solar Thermal Air Heating Farm Applications

- A blower draws air inside the building into a collector where the air has been heated by the sun and returns the heated air to the building.
- On a sunny day, the air temperature can increase by more than 40°F inside the space being heated.
- Supplemental heating is usually installed using conventional oil, gas, or electricity for overcast days.
- This type of solar heating can be used to heat a number of buildings with good southeast exposure.
- This system cost about $7,000 installed.



Solar Thermal collectors installed on an Equipment Garage
Basic Diagram – Solar Thermal Air Heating

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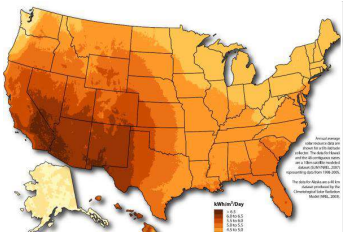
Solar Energy—A Rising Star

Solar capacity exceeded 30 GW in 2016 and is increasing exponentially



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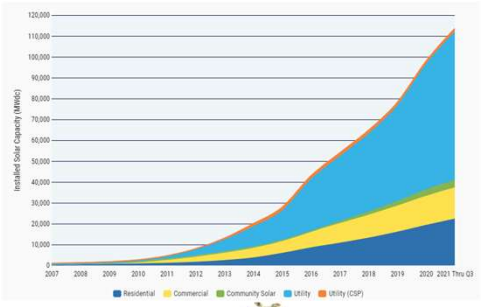
US Solar Installations – Solar Energy Industries Association (SEIA)



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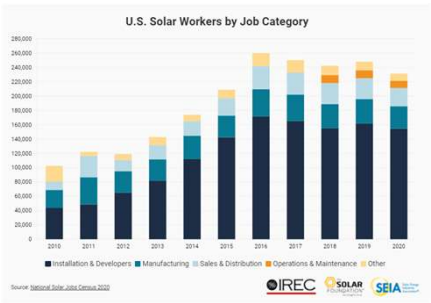
As an Economic Drive



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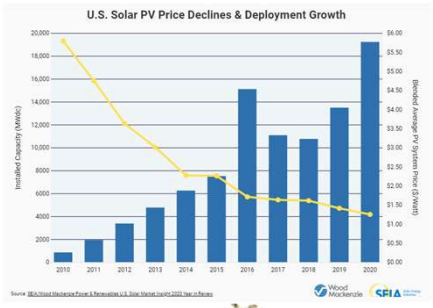
Price Declines vs. Growth



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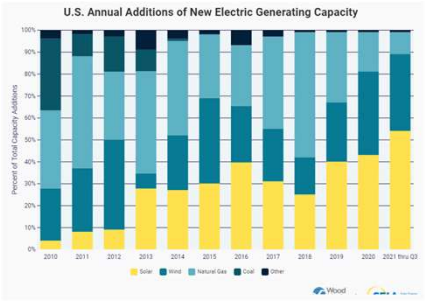
NEW Electrical Generating Capacity in the US



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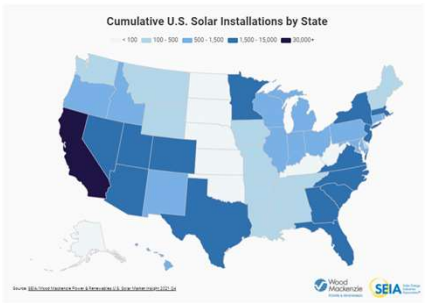
Cumulative US Installations



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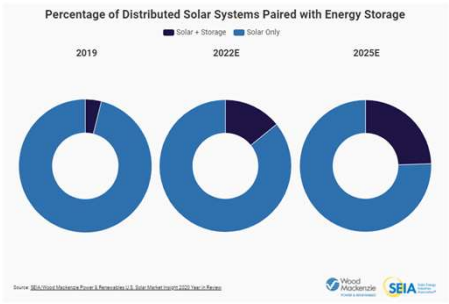

Challenge? Storage!

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Why The Interest and Growth

- Future growth viewed as almost unlimited
- Tax breaks drive a number of purchases and installations
- The sun shines on a pretty frequent basis
- Solar panel efficiency has increased greatly
- Viewed as friendly to the overall environment
- Can long term reduce the energy user's costs
- Can sell un-needed power back to the grid
- Batteries over the past couple of years
  - Increased storage
  - Lower costs
  - More readily available

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Potential Hazards

- Hail
- Fires (with risks to firefighters as well)
- Lightning
- Theft
- Natural hazards
  - Flood – Earthquake – Wildfires

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Insurance for Solar Installations

- Residential solar energy installations usually covered as part of a standard Homeowners/Farmowners policy
  - Typically offers protection against perils such as
    - Theft/vandalism
    - Storm damage from high winds, lightning, tornado, or hail
    - Fire
    - Snow and ice
  - Check for restrictions
  - Confirm coverage during installation
  - Include the value in the sum insured for the building
  - Some projects are leased – review agreement to f=determine responsibility

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BioMass

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What is BioMass

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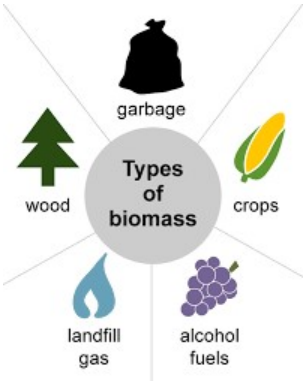
Types of Biomass



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WHY Is Biomass Considered Renewable

- Biomass is considered a renewable energy source because its inherent energy comes from the sun and because it can regrow in a relatively short time.
- The idea is that if trees harvested as biomass are replanted as fast as the wood is burned, new trees take up the carbon produced by the combustion, the carbon cycle theoretically remains in balance, and no extra carbon is added to the atmospheric balance sheet—so biomass is arguably considered "carbon neutral."
- Since nothing offsets the CO2 that fossil fuel burning produces, replacing fossil fuels with biomass theoretically results in reduced carbon emissions.

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What is an Anaerobic Digester (AD)?

aka Methane Digester

- Anaerobic manure digesters collect manure and convert the energy stored in its organic matter into methane, which is used to produce energy (gas or electricity) for on-farm or off-farm use.
- Anaerobic digestion is the process that decomposes manure, food waste, or any organic material to produce and collect biogas.
- Biogas, consisting of approximately 50-70 percent methane and 30-40 percent carbon dioxide and trace gasses, is generated when organic material degrades in the absence of oxygen.
- Since biogas is a mixture of methane (also known as natural gas or CH_4) and carbon dioxide, it is a **renewable** fuel produced from waste materials and is part of a **sustainable** residuals management system.

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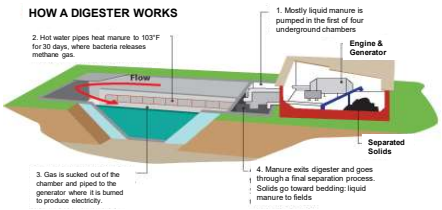
Methane Digester



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Why Install An AD On Your Farm?

- **Environmental benefits**
  - Turns manure into a source of renewable energy
  - Improves air quality by reducing odors and greenhouse gas emissions
  - Protects water quality by reducing the potential for pathogens to enter surface or ground water

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Why Install an AD?

- **Practical benefits**
  - Generates energy that can be sold
  - Generates heat or other energy for on-farm use
  - May qualify for carbon credit payments
  - Aids manure management by making solid-liquid separation easier
  - Results in potentially higher-quality manure for use on crops (more nutrient-rich and fewer weed seeds)
  - Enables animal bedding to be reused
  - Reduces feedlot problems with flies

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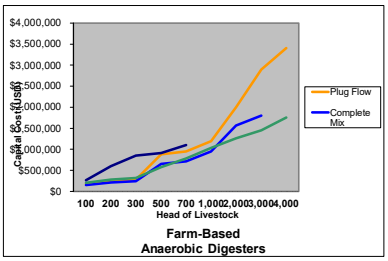
Replacement Cost – By Anaerobic Digester Technology Types



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Methane Digesters—Risk Issues

- Biogas produced when manure is anaerobically digested is primarily composed of methane and carbon dioxide, with lesser amounts of hydrogen sulfide, ammonia, and other gases.
- Biogas risks include
  - Fire/Explosion
  - Asphyxiation
  - Disease
  - Hydrogen sulfide poisoning.

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Biomethane

Gas cleaning & compressing plant

Utility Pipeline Connection

Vintage Dairy – Fresno, CA

- Covered lagoon
- 2,600 cows
- 140 tons of manure collected each day
- Fuel powers over 1,300 homes

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Considerations

- Initial cost can be significant
- Length of time for ROI
- Insurance considerations include
  - Workers' Compensation
  - Pollution
  - General liability

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Strategic Issues With Renewable Energy

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Strategic Risk Issues – Renewable Energy

- A classic risk challenge for utilities
- "Stick with the knitting" or "All in"
- Renewable contracts present new challenges/opportunities
  - Development risk
  - Technology risk
  - Performance risk
  - Obsolescence risk
  - Weather risk
  - Political/Regulatory risk
- Contractual risk transfer is a key component

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Renewable Energy Tax Incentives

- Renewable Energy Certificates (RECs) package environmental benefits produced by renewable energy into a credit that can be sold separately from the actual electricity produced
- A REC represents the collective advantage in reduced emissions of harmful pollutants (carbon, mercury) as a result of generating one MWh of renewable energy
- May take on a life of its own and be sold on a secondary market
- May be insured against potential change in tax code

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Portfolio or Independent Insurance Program?

- Renewables are often insured under stand-alone insurance programs:
  - Lender requirements – deductibles
  - Desire for manuscript wording
  - Appetite of core program provider
  - Desire for expert claims and loss control expertise

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Thank You !

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