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Landowner Educational Seminar Winter 2024

Green Energy





Green Energy?











- United States' wind power capacity was 145,569 megawatts in Q1 of 2023
- Largest renewable energy source in the U.S.
- In 2021, U.S. wind power capacity additions equaled 13,400 MW
- Represents \$20 billion investment in new wind installations



- Wind energy only made up 0.2% of U.S. electricity generating capacity in 1990
- Wind energy now provides more than 10% of U.S. electricity generation.
 - More than 60% in Iowa
 - More than 40% in Kansas and Oklahoma
 - More than 30% in Colorado, New Mexico, and North Dakota

































Wind Power Capacity

| Top States | Wind Electricity Generation (Terawatt hours) | Wind's Share of State's Electricity |
|--------------|--|--|
| Texas | 113.88 TWh | 28.6% |
| Iowa | 44.66 TWh | 64.0% |
| Oklahoma | 37.42 TWh | 44.0% |
| Kansas | 29.47 TWh | 47.5% |
| Illinois | 23.06 TWh | 11.1% |
| Colorado | 16.71 TWh | 33.1% |
| North Dakota | 16.57 TWh | 39.9% |
| California | 15.69 TWh | 17.0% |
| New Mexico | 14.48 TWh | 37.4% |
| Minnesota | 14.27 TWh | 27.6% |

Data as of 2023 Source: Statista.com, ChooseEnergy.com www.Hertz.ag



- Components of wind turbines installed in the U.S. are manufactured here
- More than 500 wind-related manufacturing facilities across the U.S.
- The U.S. wind industry currently employs about 120,000 people, including 23,600 in manufacturing and 43,400 in construction



Solar Installations





Largest Solar Farm



- Largest operating solar farm is in Los Angeles and Kern Counties in CA. Roughly 5,100 Acres. Powers nearly 255,000 homes producing 579 million watts/yr.
- Mammoth Solar Project in Indiana is under construction, will be 13,000 acres when completed.



Solar Projects

- In 2022, utility-scale solar power generated 145.6 terawatt hours of electricity in the US
- In 2011, solar power generation hovered just below two terawatt hours
- New installation surged in 2020, but was affected by sourcing problems for panels
- In the U.S., a high number of <u>solar-related</u> jobs are based in California



Solar Projects

- Large surface areas can concentrate rainfall runoff and cause erosion on adjoining parcels.
- Limited number of projects that have been retired and returned to farming. What will that look like?
- Oscillating panels increase hours of effective sunlight captured adding 25% capacity.



Solar Installations







Wind vs. Solar Comparisons

- Solar panels are cheaper, more compact, and more widely tolerated in urban and suburban environments
- They can absorb some light on cloudy days whereas turbines only spin when it's windy
- Wind turbines can produce electricity at night or on very cloudy days as long as there is wind
- Both are more consistent if there is a way to store energy produced...but adds expense



Wind vs. Solar Comparisons

- Solar panels take up 16 50 times more space than a wind turbine to produce same amount of energy depending on turbine size
- Technology continues to improve in both industries
- Overall, wind power is considered the more efficient and environmentally friendly option.
- Solar converts 14-20% of solar energy, wind turbines 50-60% of wind energy





* and other gases Stored hydroelectric energy not deducted Source: U.S. Energy Information Administration



Green Energy Contracts

- Annual payments for turbines range from \$2,000 to \$5,000 per MWh nameplate capacity
- Annual payments for solar projects range from \$800 to \$2000 per acre
- Both may have additional payments for surface facilities or underground transmission lines





Green Energy Contracts

- Landowners should carefully review the contract terms and seek legal advice.
- Contracts vary widely it's important to ensure that the terms are fair and favorable to the landowner.
- Once committed to a contract, it may restrict use of land and surrounding land for decades.





Green Energy Contracts

- Contracts should specify:
 - The Lease Term
 - Renewal Terms
 - Specific Acres and Parcels Involved
 - -What Happens if the Equipment is Damaged
 - Accessibility
 - -Amount Landowner Will be Paid
 - Escalation of Payments
 - Who Cleans Up After the Contract Ends.



Impact on Land Values <u>Wind</u>

- Wind Turbines may add from \$1,000 to \$2,500 per acre to a land sale
- Buyers use discount rates from 8% to 40%
- Depends on contract terms and remaining length
- Some buyers refuse to consider a farm with a turbine(s) on it
- Others seek out the opportunity



Impact on Land Values <u>Solar</u>

- Less sales with solar contracts available
- Assume buyers will use similar range of discount rates
- More questions around options for using the land for other purposes after contract expiration and cleanup
- Potential negative effects on surrounding acres







Use of Agricultural Products in Green Energy



BioFuels

- Future of Ethanol
- Renewable Bio-Based Fuels for Mass Transportation
- Advanced Biofuels for Energy Production





Renewable Fuel Standard



https://afdc.energy.gov/laws/RFS

Source: U.S. Dept. of Energy, Alternative Fuels Data Center



Electric Vehicle Use

- Federal Gov't Goal = 50% of vehicles sold to be EV by 2030
- Average age of U.S. vehicles is 12.5 years*
- 68% of road miles driven are rural**



*According to S&P Global Mobility article "Average Age of Light Vehicles in the US Hits Record High 12.5 years" **According to Southern Alliance for Clean Energy article (https://cleanenergy.org/blog/rural-mobility/)



Projected EV Sales



According to our Annual Energy Outlook 2023 (AEO2023), we project that electric vehicles (EVs), including both batteryelectric vehicles (BEVs) and plug-in hybrid electric vehicles (PHEVs), will account for between 13% and 29% of new lightduty vehicle sales in the United States in 2050 and between 11% and 26% of on-road light-duty vehicle stocks



Projected Ethanol Production



https://fapri.missouri.edu/wp-content/uploads/2023/03/2023-Baseline-Outlook.pdf



Source: U-M FAPRI, 2023 US Agricultural Market Outlook



Still Demand for Ethanol

- E15 available year-round
- Use in Sustainable Aviation Fuel
- Ethanol plants' sequestration of carbon
- Potential for increased ethanol blend requirements in export markets
- Greenhouse gas emissions from ethanol are 52% lower than gasoline*

*According to a 2021 Department of Energy Report



Renewable Bio-Based Fuels



Fuel the Crush: Renewable Diesel Pumps UP Soybean Demand https://www.agweb.com/news/crops/soybeans/fuel-crush-renewable-diesel-pumps-soybean-demand





Sustainable Aviation Fuel (SAF)

- Aviation makes up 9-12% of U.S. transportation greenhouse gas emissions
- Can be blended up to 50% with traditional jet fuel
- Reduces carbon emissions up to 80% depending on the feedstock

According to the U.S. Department of Energy





Renewable Diesel

- Produced in similar process used to refine crude oil
- Can be used as 1:1 replacement for petroleum diesel
- Reduce CO₂ and N₂O emissions by 65% compared to petroleum diesel
- Some older refineries are being converted, driven by Renewable Fuel initiatives

According to the US Department of Energy: Alternative Fuels Data Center



Increasing Demand for Soybean Oil



Source: CHS article "Soy oil demand soars", https://www.chsinc.com/about-chs/news/news/2023/02/27/soy-oil-demand-soars#:~:text=The%20need%20for%20more%20soybean,processing%20expansion%20for%20whole%20beans.&text=Once%20a%20surplus%20product%2 0looking,sought%2Dafter%20renewable%20fuel%20feedstock.





Source: CHS global research

Nearly 91 million acres of soybeans will be needed to support projected U.S. soybean oil crush demand, says Joe Lardy, CHS research analyst. "American farmers have planted more than 90 million acres of soybeans only once before, in 2017, so we'd be moving to a whole new level of production. It begs the question, which commodities will give up acres to make room for more soybeans?"



Advanced Biofuels

- Plant biomass can be an alternative energy source to fossil fuels
 - -Corn stover (Verbio)
 - -Miscanthus (University of Iowa)





Corn Stover

Converting corn stover to natural gas
Verbio plant in Nevada, IA
Plans to use utilize 30,000 acres of corn
Corn stover is shredded then decomposed in a digester to create biomethane gas
Gas is channeled into an Alliant Energy natural gas pipeline for consumer use





Miscanthus



- University of Iowa
- Replacing coal in power plant
- Planted by rhizomes
- Perennial crop lasts 10-12 years

- Harvested in early spring
- Pelletized
- Burned in power plant





Miscanthus

- More effective than cover crops at reducing nutrient loss
- Provides wildlife habitat
- Grows 12 feet tall
- Planted on more than 2,000 acres in eastern lowa





Impact on Land Values

Renewable Fuels

- Renewable Diesel, Ethanol and SAF will affect land values via their impact on commodity prices.
- Less direct attribution to value.
- Much harder to factor into land buying decisions.



CLARITY ON CARBON'S POTENTIAL AMERICA'S CONSERVATION AG MOVEMENT **HOW TO CASH IN ON CARBON'S PROMISE** TRADE LLEAN TONNES PROJECT AMOUNT GASES ESTABLISHED EMIT DEVELOPMENT QUOTAS TRADING ADDITIONALITY CLIMAT PROVIDE DEVELOPED



DIVE IN? Skepticism regarding carbon markets reigns among farmers. sense that the total level of allowable emissions from this industry, hence the total number of pollution permits that you issue, must be lower



Carbon in Agriculture

Why is carbon important?

- Carbon dioxide makes up nearly 80% of U.S.
 Greenhouse Gas Emissions
- Initiative to reduce carbon emissions across all sectors
- Agriculture is part of the solution





Image Source: Environmental Protection Agency



Apple is carbon neutral. And by 2030, all of our products will be too.

We're designing the world's most innovative products from recycled materials. Soon we'll make them all with clean energy and no carbon footprint. Some say it's impossible. At Apple, we think different.

> WALMART'S PATH TO ZERO EMISSIONS 2040

NET ZERO CARBON **BY 2040**

It might sound ambitious-but that's the point.

THE Paris... CLIMATE IO years PLEDGE Early

We pledge to achieve carbon neutrality in our facilities and operations in the next 14 years. Here's where we stand today:



~3.000

ACRES

remediated and restored

as valuable community

assets

FIG. 1M

~70% IMPROVEMENT in energy efficiency since 2004

155

MILLION GALLONS

of water saved in

water-stressed

areas since 2013

5.700 SUSTAINABILITY

projects since 2010

OF NEW PRODUCT RESEARCH AND DEVELOPMENT investment focused on solutions



MILLION CARS the equivalent of the number of cars removed from the road for one year thanks to Solstice

Honeywell

-50%

that improve environmental and social outcomes for customers

THE LONG-TERM STRATEGY **OF THE UNITED STATES**

Pathways to Net-Zero Greenhouse Gas Emissions by 2050

NOVEMBER 2021



Carbon Credits

- <u>Carbon Neutral Promises: How?</u>
 - 1. Reducing direct and indirect emissions
 - Facilities, transportation, electricity, fuel, energy, purchased goods, etc.
 - 2. Purchasing offset credits
 - Why agriculture?



Carbon Cycle









Image Source: Cornell University



Carbon in Agriculture

- How do we build soil carbon?
 - -Reduced Tillage and Cover Crops
 - Reducing soil disturbance
 - Frequent living root systems below ground
 - Decomposing crop residue
 - -Reducing synthetic fertilizer usage
 - Capturing between 0.5 to 1.0 ton of carbon per year per acre





Carbon Brokers



Soil and Water Outcomes Fund













Carbon Credit Contracts

- Opportunity to be paid for implementing new carbon-building practices
- Farm data sharing required
- Producers currently being paid \$15-30/acre on average
 - <u>Farm Journal:</u> 93% of farmers are aware of carbon markets vs. only 3% participating.
 - Little incentive to implement new practices at below breakeven cost
 - What will the market bear in years ahead?



Inflation Reduction Act

- <u>45z Tax Credit</u>: Incentivizing biofuel producers to lower their carbon intensity (CI) score
 - Tax credits available starting Jan 1, 2025, for biofuel producers that lower their score enough
 - Motive behind carbon capture pipelines
 - Low-carbon grain could also be part of the solution
 - Grain producers who have a low CI score <u>could</u> receive a premium for bushels
 - No programs in place yet. Grain produced in 2024 may be eligible for lowering CI score



Emissions Types





Image Source: EPA www.Hertz.ag



Carbon Pipelines

- Pipelines proposed to capture carbon dioxide emissions from ethanol and fertilizer production plants and store below ground
- Intent is to lower emissions and make ethanol a more "carbon friendly" fuel
- So far, permits have been denied
- Companies involved are pulling back and will most likely rework and refile their permit requests









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