January 10, 2024: WV Envirothon Renewable Energy Training Day

WVU Jackson's Mill Annette S. Boggs STEAM Education Center

Part I: Sustainable Bioenergy Production
Part II: Communication Skills, Oral Presentation Tips & Best Practices

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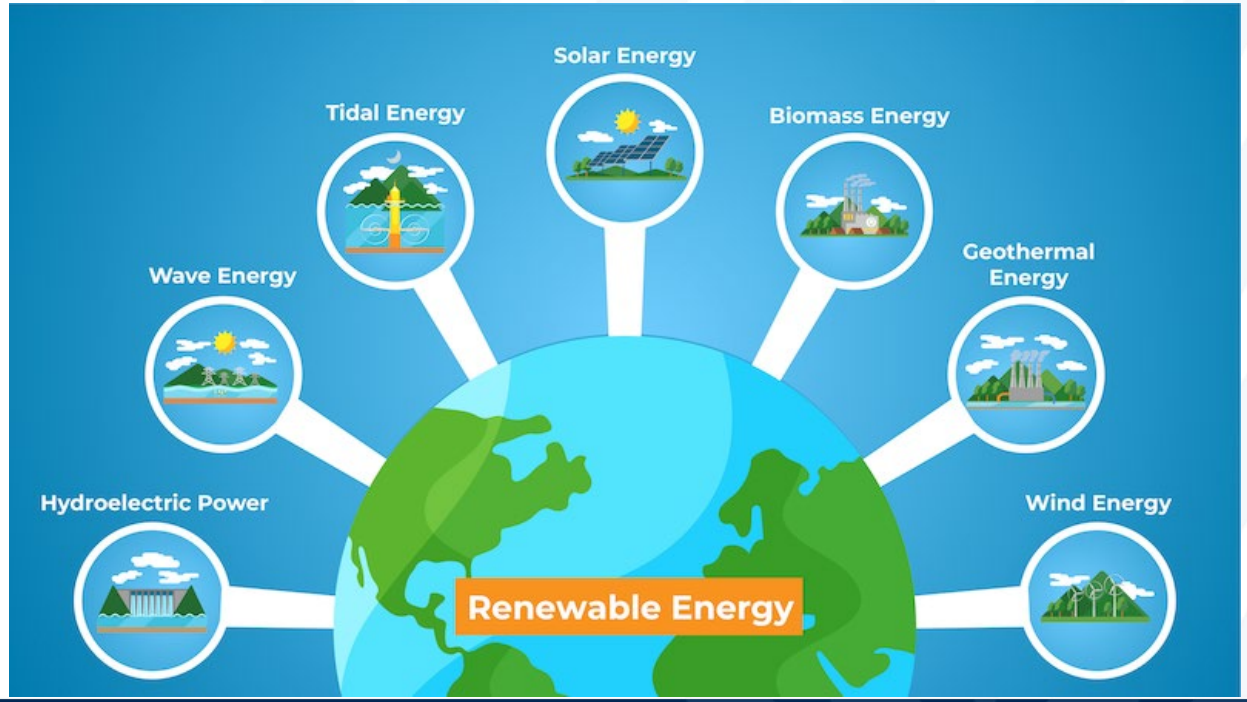
What is Renewable Energy?

U.S. Department of Energy Definition:

- Renewable energy is energy produced from sources like the sun and wind that are naturally replenished and do not run out. Renewable energy can be used for electricity generation, space and water heating and cooling, and transportation.
- Non-renewable energy, in contrast, comes from finite sources that could get used up, such as fossil fuels like coal and oil.

Renewable Energy Sources



Many Positives: Sustainable Bioenergy

As per the U.S. Energy Information Administration

- West Virginia has many clean energy opportunities, such as wind, solar, biomass, hydropower, and other renewable energy resources.
- In 2021, 5% of West Virginia's total net generation came from renewable resources, nearly all of it from hydropower and wind energy in almost equal amounts.

In 2021, West Virginia was the nation's second-largest coal producer, after Wyoming.

In 2020, crude oil production in West Virginia reached an all-time annual high of more than 19 million barrels.

West Virginia is the nation's fourth-largest energy producer.

West Virginia is the fourth-largest producer of marketed natural gas in the nation.

Solar Energy

Solar thermal energy systems are used to

- Heat water for use in homes, buildings, or swimming pools
- Heat the inside of homes, greenhouses, and other buildings
- Heat fluids to high temperatures in solar thermal power plants

Solar photovoltaic devices, or solar cells, change sunlight directly into electricity.

Solar Energy

January 2024: solar site at Fort Martin Power Station in Maidsville, West Virginia

Solar Energy

The two main benefits of using solar energy are

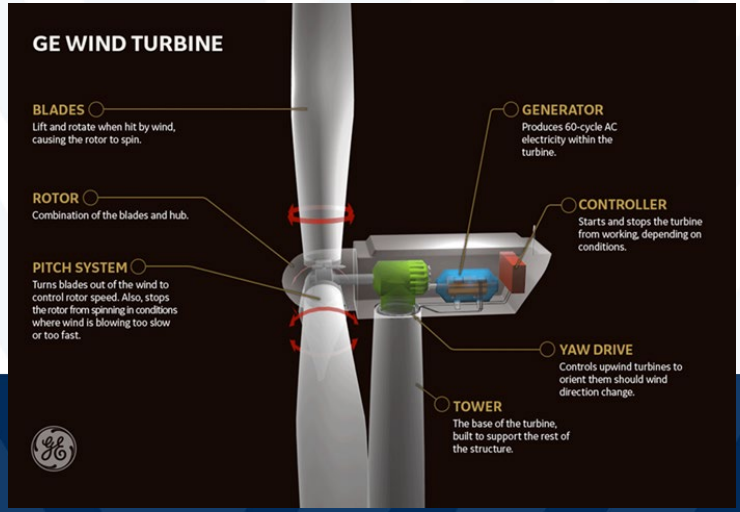
- Systems do not produce air pollutants or carbon dioxide.
- Systems on buildings have minimal impact on the environment.

The main limitations of solar energy are

- The amount of sunlight that arrives at the earth's surface is not constant. The amount of sunlight varies depending on location, time of day, season of the year, and weather conditions.
- The amount of sunlight reaching a square foot of the earth's surface is relatively small, so a large surface area is necessary to absorb or collect a useful amount of energy.

Wind Energy

- Wind turbines operate on a simple principle. The energy in the wind turns two or three propeller-like blades around a rotor. The rotor is connected to the main shaft, which spins a generator to create electricity.



Wind Energy

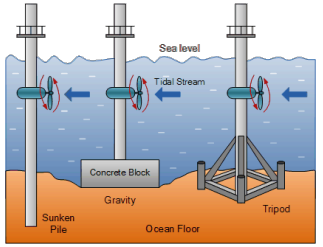
- Wind turbines are mounted on a tower to capture the most energy. At 100 feet or more above ground, they can take advantage of faster and less turbulent wind.
- Wind turbines can be used to produce electricity for a single home or building, or they can be connected to an electricity grid for more widespread electricity distribution.

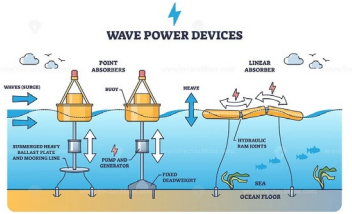
Wind Energy

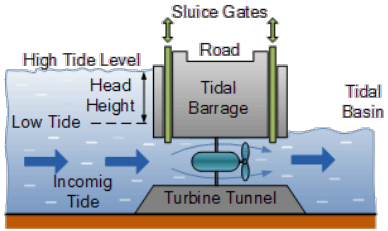
- Advantages of Wind Energy
  - Clean and renewable source of power
  - Cost effective
  - Rapid growth of industry, large potential
- Disadvantages of Wind Energy
  - Wind reliability
  - Threat to wildlife
  - Noise and visual pollution

Tidal and Wave Energy

- Tidal Stream Generator
  - Makes use of the kinetic energy of moving water to power turbines in a similar way to wind turbines that use wind to power turbines.
- Tidal Barrage
  - Tidal barrages use the potential energy in the difference in height between high and low tides.
- Other forms: Wave Energy
  - Wave power devices extract energy from the surface motion of ocean waves or from pressure fluctuations below the surface.







Tidal and Wave Energy

Advantages

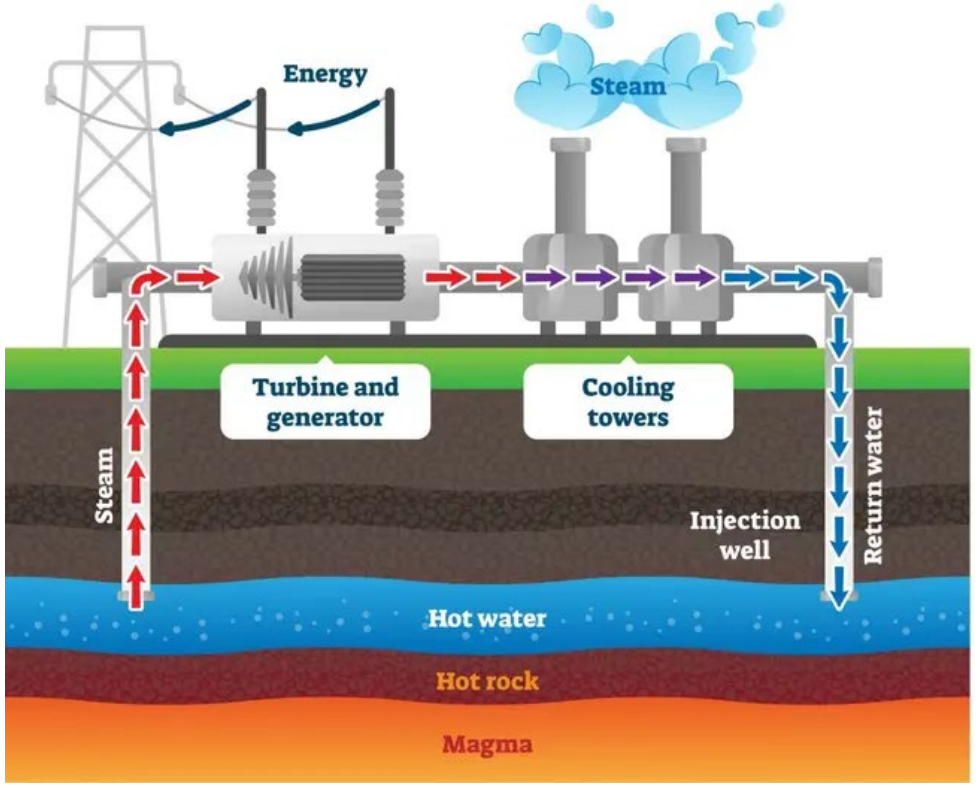
- Clean fuel source compared to fossil fuels
- Domestic source of energy

Disadvantages

- Tidal power, or wave energy can have effects on marine life.
  - The turbines can accidentally kill swimming sea life with the rotating blades.
  - Some fish may no longer utilize the area if threatened with a constant rotating or noise-making object.
  - Installing a barrage may change the shoreline within the bay or estuary, affecting a large ecosystem that depends on tidal flats.

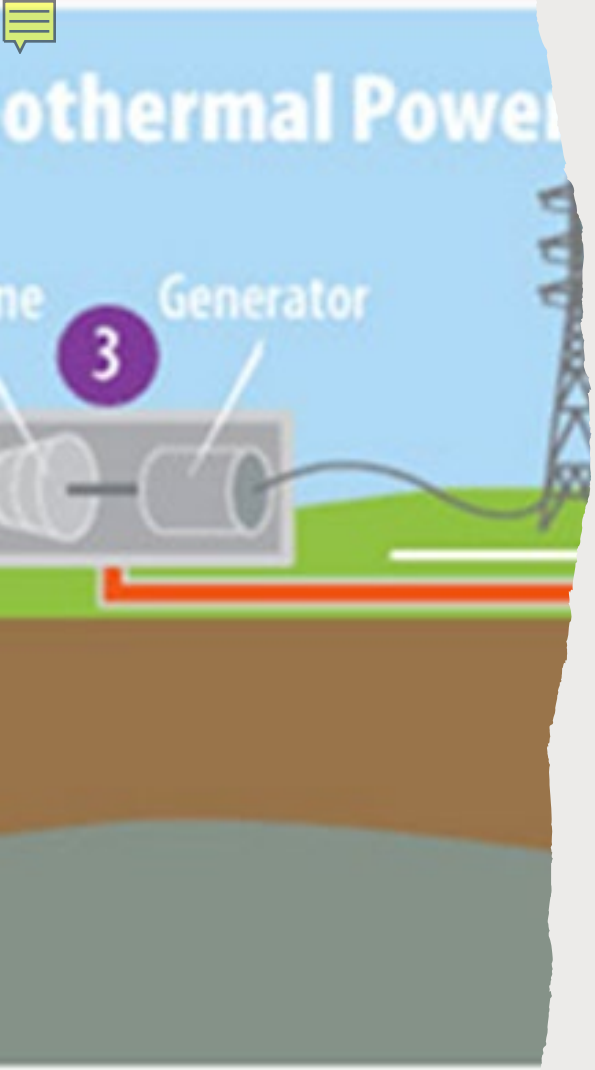
Geothermal Energy

- (geo = earth and thermal = heat)
- Geothermal energy comes from heat produced by the Earth.



Geothermal Energy

- **Direct geothermal energy** can be accessed in areas where hot springs/geothermal reservoirs are near the surface of the Earth.
- **Geothermal heat pumps** utilize underground pipes, an electric compressor, and a heat exchanger to absorb and transfer heat.
- **Geothermal power plants** also harness the heat of the Earth through hot water and steam. In these plants, heat is used to generate electricity.



Geothermal Energy

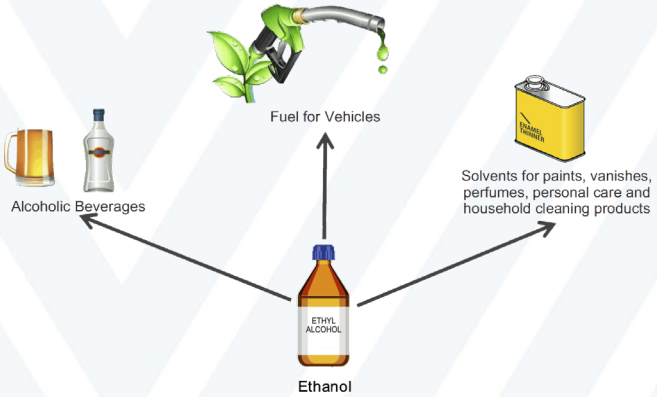
- Advantages
  - Renewable energy
  - Cleaner than burning fossil fuels
- Disadvantages
  - Cost of drilling, researching proper areas
  - Requires a suitable location

Biofuels

- The two most common types of biofuels are **ethanol** and **biodiesel**.

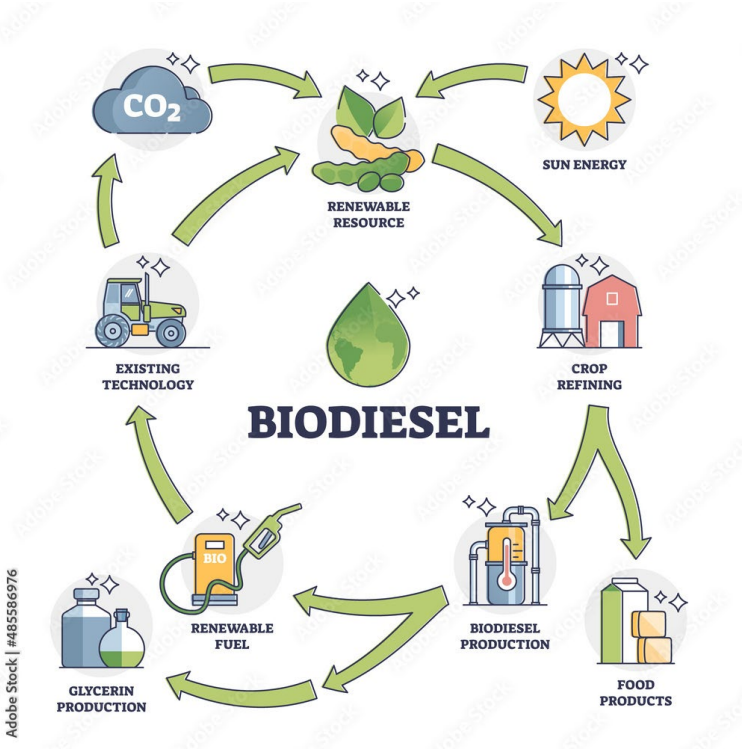
Biofuels: Ethanol

- Ethanol is an alcohol.
- Ethanol is mostly used as a fuel additive to reduce vehicle carbon monoxide and other smog-causing emissions.



Biofuels

- Biodiesel is made by combining alcohol (usually methanol) with vegetable oil, animal fat, or recycled cooking greases.
- It can be used as an additive to reduce vehicle emissions (typically 20%) or in its pure form as a renewable alternative fuel for diesel engines.



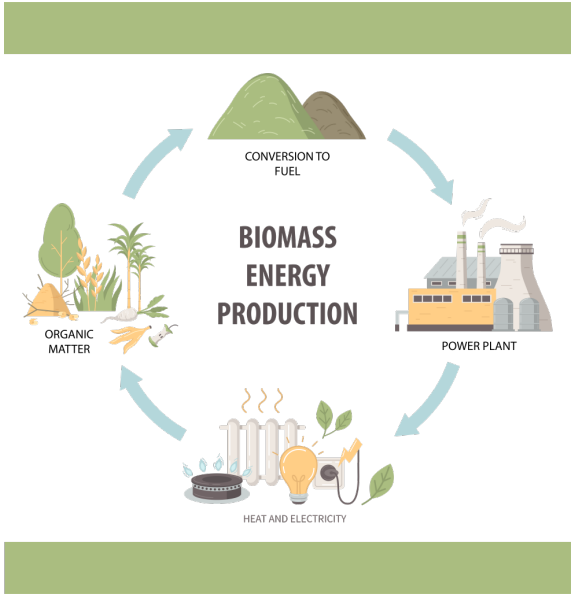
Biofuels

- **Advantages**
  - Easy to source
  - Renewable
  - Reduces greenhouse gases
  - Reduced dependence on foreign energy
- **Disadvantages**
  - Higher cost of production (lower supply than gasoline)
  - Monoculture
  - Shortage of food
  - Water Use

What is the Role of Woody Biomass in Energy Production?

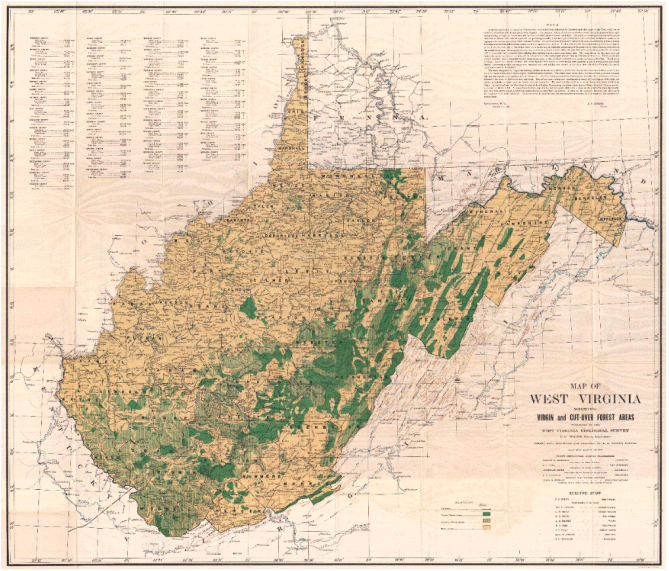
Advantages of woody biomass:

- Very available. There's lots of it
- It is renewable and sustainable
- Often does not require high fertilization
- Can reduce waste streams
- Reduced nutrient runoff related issues
- Better for water quality
- Does not increase atmospheric levels of CO2
- Locally produced
- …

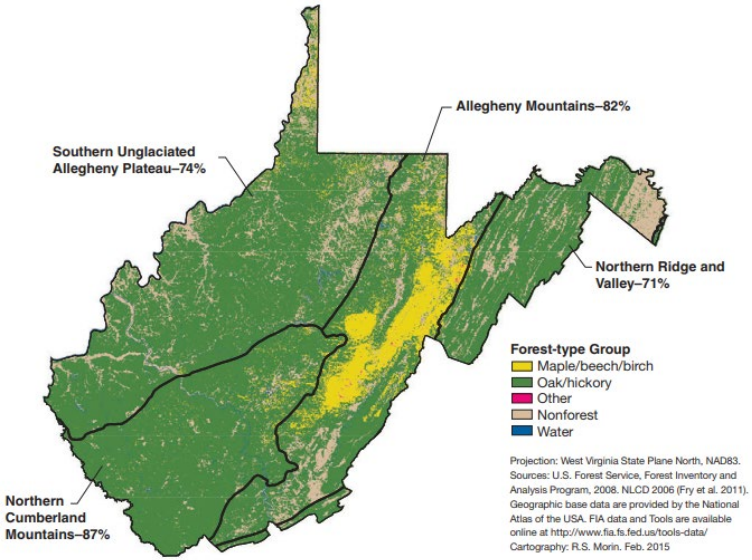


West Virginia Forest Cover: A Massive Biomass Savings Account

1909 (72% Agriculture)



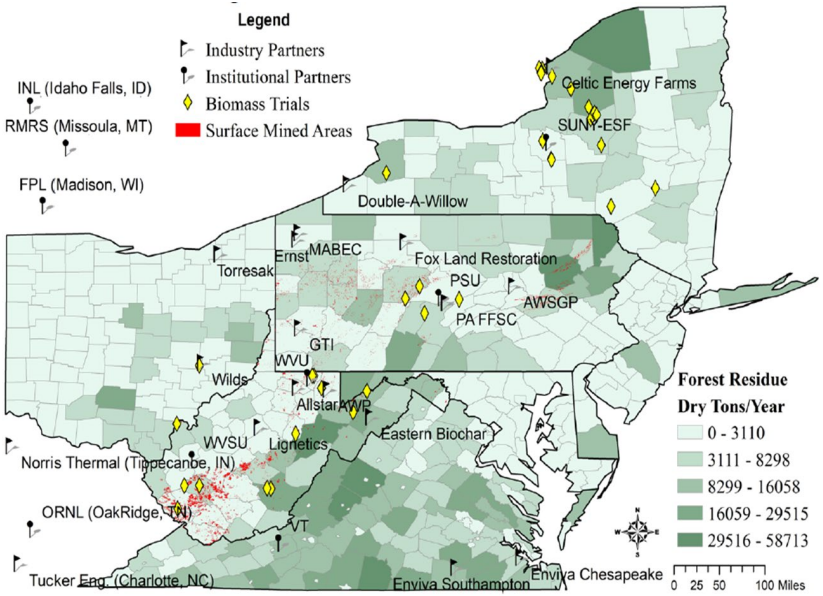
2023 (82% Forest)



Current Biomass Research

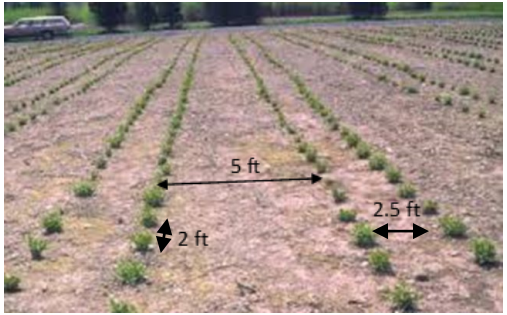
Mid-Atlantic Sustainable Biomass for Value-added Products Consortium

- MASBio study region with existing and ongoing biomass trial sites, and residue availability.
- Deliver a sustainable and economically feasible biomass for value-added products system in the Mid-Atlantic region of the U.S.
- Promote the regional decarbonized bioeconomy



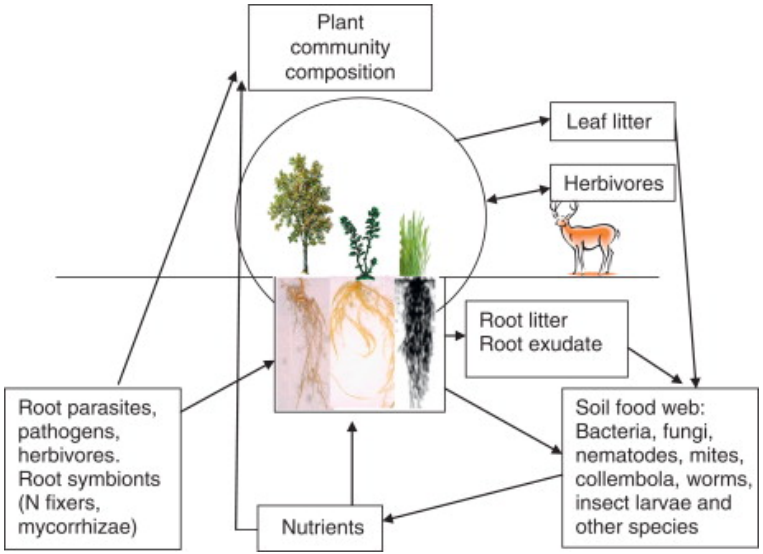
Jackson's Mill Biomass Production Trial

- Crops planted in spring 2021
- Willow is a hybrid cultivar grown on a 3-year rotation
- Switchgrass: Harvested beginning in 2023



Biomass Production and Nutrient Runoff

- Biomass has woody roots
- Woody roots hold soil in place
- Woody biomass increases soil organic matter
- Woody biomass increases soil habitat and biota
- Woody roots encourage soil infiltration through larger soil pore spaces and preferential flow-paths
- Encourages natural bioremediation of water and improves water quality
- Biomass crops often require less fertilizers and can grow on marginally productive land



Recap: Renewable Energy 101

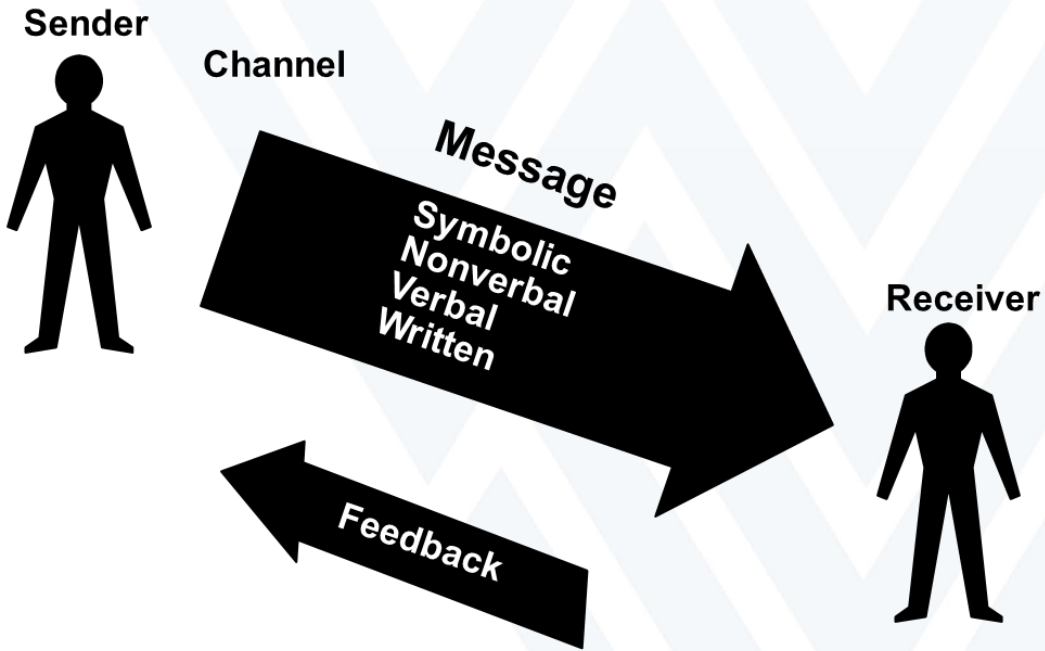
National Geographic (~3:17)

Your Charge: Renewable Energy 5th Topic

- Develop a proposal to enhance bioenergy crop management, targeting mitigation of nutrient runoff and improving water quality.
- Propose innovative approaches and strategies to minimize the environmental impact of bioenergy cultivation, ensuring its long-term viability and
- Select a companion renewable energy type that is suitable to your site (see your scenario, pg 2) and can work in tandem with bioenergy production

Communication Skills, Oral Presentation Tips and Practices

Communication Skills



Understanding Depends On

- Communication skills
- Attitudes
- Experience
- Knowledge

Understanding Depends On

- Self-concept
- Rights
- Responsibilities
- Feelings
- Assessment of what is valuable or worthwhile

Communication will be effective when the sender and receiver feel positive and respectful of each other

Communication Channels

- Symbolically
- Nonverbally
- Verbally
- Written
- Electronically

Effective Sending

- Self-awareness of thoughts and feelings
- Freedom of expression
- Awareness of the listener

Active Listening Behaviors

- No interruptions
- Body language conveys interest
- Eye contact
- Restating sender's words

Active Listening Behaviors

- Encouragement
- Open-ended questions
- Clarification
- Summarizing
- Being non-judgmental

Active Listening Suggestions

- Be fully accessible
- Be aware of own feelings
- Maintain self-esteem of others

Active Listening Suggestions

- Acknowledge feelings with empathy
- Check for understanding
- Make suggestions about the process

Blocks to Communication

- Evaluating
- Advice-giving
- Discounting
- Diagnosing or being psychoanalytical

Blocks to Communication

- Prying
- Warning, admonishing, commanding
- Lecturing
- Devaluing

Tips for Conducting an Oral Presentation

Handout

Developing Messaging for Tangible Research and Programs

Colleagues
Students
Supervisors
Administrators
Friends
Family
Children

…don't believe in WHAT you do. They believe in WHY you do it.

Setting Academia: *The Others*:

- WHAT• "We educate students and grant degrees,"
- HOW• "Our graduates are educated using all the current standards to facilitate their entry to a global workforce,"
- WHY• "Don't you want to hire one of our graduates"?

Setting Academia: *The Inspired*:

- WHY• "We believe that the world is more complex than ever. Everything we do is to prepare our students for that world,"
- HOW• "Our students are educated to solve the greatest challenges of our time as future leaders. They also happen to earn a degree."
- WHAT• "Don't you want to hire one of our graduates"?

Simon Sinek: https://www.youtube.com/watch?v=Extb2g1yrG0

Phases of Organizational Change: Tools for Change Initiatives

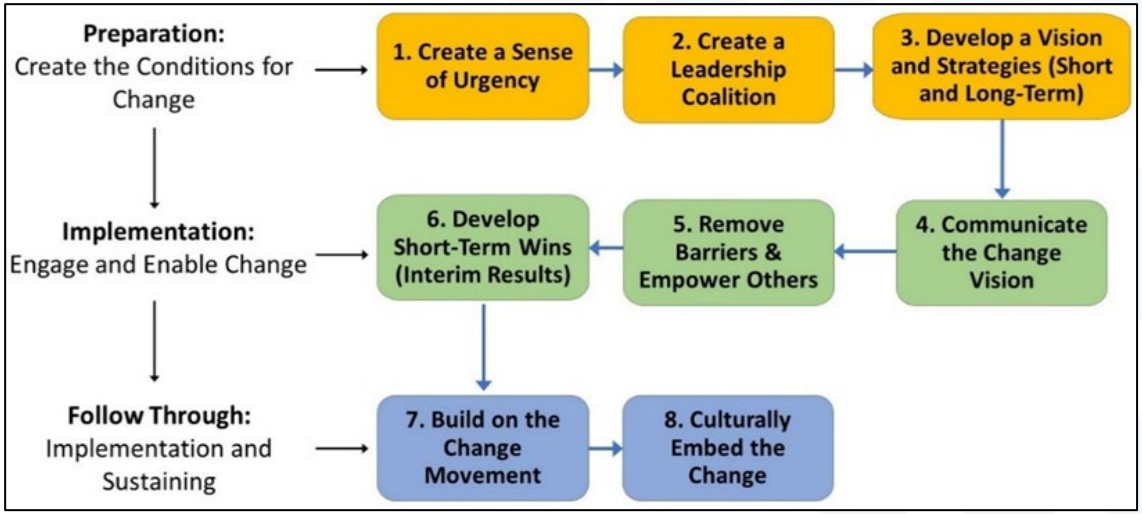


Figure. The three phases of organizational change: Preparation, Implementation, and Follow-through (left). Eight phased integrated steps for organizational change (right), revised and recreated from Kotter (2012).

Hubbart, J.A. 2023. Harmonizing Science and Society: A Change Management Approach to Align Scientific Endeavors with Societal Needs. Sustainability

Hubbart, J.A. 2023. Organizational Change: The Challenge of Change Aversion. Administrative Sciences, 13(162):1-9. DOI: 10.3390/admsci13070162

Hubbart, J.A. 2023. Organizational Change: Considering Truth and Buy-In. Administrative Sciences, 13, 3, 1-8. DOI: 10.3390/admsci13010003

Making Your Research Matter

- Stakeholder engagement and buy-in are critical.
  - Buy-in occurs through truth-telling and earning trust.
- You want our work to make a difference, matter, and improve circumstances for future generations.
  - The amount of effort this takes will require you always to embrace your WHY
- Success in proposals – researching, working with stakeholders – scholarship.
  - Are about people believing what you believe (your WHY). These are Change Initiatives, and your audience must be on board.

Thank You

Acknowledgments:
Thanks are due to the many past and present scientists of the Interdisciplinary Hydrology Laboratory (https://www.researchgate.net/lab/The-Interdisciplinary-Hydrology-Laboratory-Jason-A-Hubbart). National Science Foundation (01A-1458952 and others), US Environmental Protection Agency, USDA National Institute of Food and Agriculture (various), USDA Hatch (various), West Virginia Agricultural and Forestry Experiment Station, WVU Institute of Water Security and Science, WVU Davis College, University of Missouri, City of Columbia, Boone County, University of Idaho, Interns, volunteers, and landowners, colleagues, mentors, graduate students. Many others not listed here. Results presented may not reflect the views of the sponsors and no official endorsement should be inferred.

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