

**COMMISSION ON UNIVERSITY SUPPORT
MEETING
April 15, 2021
Videoconference (via Zoom)**

Present: Judy Alford, John Benner (Chair), Michael Borowski, William Dougherty *for Scott Midkiff*, Martha Glass, Bradley Klien, Polly Middleton, Debbie Greer *for Ken Miller*, Phil Miskovic, Ryan Speer

Absent with Notice: Robert Sumichrist

Absent: Jeff Earley, Chris Kiwus, Charlie Phlegar, Patrick Pithua, Kimani Jackson, Connie Stovall

Guests: Richard Ashley, Denny Cochrane, John Ignosh, Christina King, April Myers

Recorder: Teresa Thompson

1. Welcome and Roll Call

Commission Chair, John Benner, called the meeting to order at 2:00p.m.; initiated introductions and roll call. A quorum was present.

2. Approval of Agenda

Proper motion was made, seconded, and unanimously passed to accept the March 2021 agenda.

3. Approval of the March 2021 meeting minutes

Chair Benner noted that these minutes have been voted on electronically and can be publicly accessed on the Governance Information System on the Web (<http://www.governance.vt.edu>).

4. Old Business

No old business for discussion.

5. New Business

John Ignosh, Specialist with Biological Systems Engineering and Virginia Cooperative Extension, who presented an overview of Virginia Cooperative Extension's outreach and program efforts with solar energy projects which presentation is attached and incorporated herein as part of the minutes.

6. Updates from Committee Representatives

Campus Development Committee – Christina King reported committee has nothing new to report. They have been reviewing capital projects in general.

Energy and Sustainability Committee – Denny Cochrane shared that progress continues with 2020 Climate Action Commitment Resolution that was approved at March 2021 Board of Visitors meeting. They completed their 5th STARS submission and the university received their third Gold rating with the highest rating yet. The Green RFP proposals have been submitted and results are pending. Earth Week is April 18-24, 2021 and Earth Day is April 22 with an extensive schedule of events planned. A flyer describing some of those events will be shared to the group by Chair Benner.

IT Services and Systems Committee – William Dougherty updated the group that Virginia Tech's license with Qualtrics has been extended and is now set to expire May 31, 2022. Question-Pro is a similar program. The voice communications system/transition is being researched and additional information will be shared as it develops.

Transportation and Parking Committee – Nothing new to report.

7. Acceptance of Committee Minutes

Campus Development Committee – February 8, 2021 minutes approved by the Commission.

Energy and Sustainability Committee – February 22, 2021 minutes approved by the Commission.

IT Services and Systems Committee – No new minutes submitted to the Commission.

Transportation and Parking Committee – February 3, 2021 and April 7, 2021 minutes approved by the Commission

8. Next Meeting Date

Chair Benner shared we will not meet in May. The Commission's next meeting will be in September 2021. He reminded everyone that submission of ideas for future meetings are very welcome.

Phil Miskovic advised this is his last meeting with us. Beginning July 1, he will serve as the graduate student representative to the Board of Visitors.

9. Adjournment

There being no further business, proper motion was made to adjourn the meeting at 3:06pm.

Respectfully submitted,
Teresa Thompson

Commission of University Support Meeting

“Virginia Cooperative Extension Renewable Energy Programs”

*Energy Management Related Extension Programming
A Brief Intro Presentation*

2PM Thursday April 15, 2021

John Ignosh
Extension Specialist, BSE/VCE-VT
Harrisonburg, VA
540-232-6009
jignosh@vt.edu



Highlighting Multidisciplinary Energy-related Extension Programs in Virginia

John Ignosh, Area Extension Specialist, Department of Biological Systems Engineering, Virginia Tech; Jennifer Abel, Senior Extension Agent, Family and Consumer Sciences, Virginia Cooperative Extension; Dr. Sarah Fogel, Community Viability Specialist, Virginia Cooperative Extension; Dan Swafford, Project Associate, Virginia 4-H State Office; Dr. Martha Walker, Community Viability Specialist, Agricultural & Applied Economics, Virginia Tech; and Matt Booher, Crop & Soil Extension Agent, Virginia Cooperative Extension

RESIDENTIAL ENERGY EFFICIENCY

Many low-income apartment renters in Arlington and Alexandria frequently struggle with paying their rent and utilities. The Energy Masters Program helps reduce energy bills for tenants or property managers and helps minimize related rent increases. Program objectives: 1) to provide energy- and water-saving retrofits in low-income apartments; 2) to educate tenants about easy actions they can take to conserve energy; 3) to provide energy-saving retrofits to 250 Arlington and Alexandria apartments. The program has grown to include new elements, including a pipeline mentorship program for 10 high school students as Energy Masters volunteers, an Energy Efficiency program in community and senior centers where attendees learn about energy efficiency, and a series of energy education lessons that volunteers have shared with 3,757 K-12 students.

Energy and Water Saving Retrofits (2011-2020)	Count
Apartment Units Completed	710
Compact Fluorescent Light Bulbs Installed	3,534
LED Light Bulbs Installed	584
Outlet and switch plates sealed	8,000
Wires sealed	248
Refrigerators sealed	43
Exhaust fans installed	730
Low-flow showerheads installed	337
Water heaters installed	284
Power strips given to residents	325
Water saved (estimated, GPD)	9,320,808
Energy saved (estimated, kWh/yr)	299,683

FARM ENERGY EFFICIENCY & RENEWABLES

The 2022 Census of Agriculture indicates that across South and Southwest Virginia, farmers spent more than \$600 in farm energy-related expenses. In 2016, Virginia Cooperative Extension partnered with agricultural service providers and agencies to secure funding from the Virginia Tobacco Commission to support the Agricultural Energy Efficiency Initiative program to identify farm energy cost saving opportunities. Retrofits are executed via a cost-share program which also includes participation in extension educational events. The program has delivered more than 20 workshops on energy efficiency best practices to renewable energy conversion technologies. During the 2014-2015 phase of the program, 64 farm energy audits identified potential annual savings of:

874,968 kWh in electricity	590,734 energy costs
429,847 gallons of propane	3,513 MTCO2E GHG

In other regions of Virginia, on-farm energy project demonstrations are used to evaluate the use of renewables to meet aspects of the Chesapeake Bay TMDL, for instance, 861 Farm Measure 6a Energy Initiative explores thermal conversion of poultry litter to digester gas while also generating a phosphorus rich co-product, and the Alternative Farming & Solar-Powered Water Pumping System for Livestock demonstrations explore using solar photovoltaics to power portable water pumping stations with integrated, and semi-permanent, fencing systems to provide water for livestock on rented pasturesland.

YOUTH ENERGY

Can you teach alternative energy in an area where coal is king?

Since the fall of 2016, the Virginia State 4-H office at Virginia Tech has conducted a program on alternative energy education for Agriculture Education Agents in Southwest Virginia. The program includes both a youth and adult component. Youth involves training on alternative energy technologies. Adults, serving as Agricultural Educators or 4-H Agents, also receive training on alternative energy technologies as well as orientations on teaching with hands-on energy laboratory kits.

To date this program has:

- Conducted 156 presentations
- Reached 1,631 students
- Engaged 26 schools
- Served 34 southwestern Virginia counties
- Trained 73 teachers & 17 peer-service teachers

COMMUNITY PLANNING & DEVELOPMENT

The interest in utility-scale solar farm projects has increased dramatically across Virginia over the last five years. More than 40 projects have been proposed as of March 2017, ranging from tens of acres to more than 1,200 acres. There are several questions local governments must address to fully prepare for this emerging land use. Likewise, opportunities and pitfalls exist for landowners. Through this program, planning commissioners, local elected officials, farm property owners, and staff planners are being educated about the technical, contractual, and policy implications of on-farm and off-farm solar projects. For example, in November 2016 the Solar Farm Workshop for Local Governments and Planners was held in Emporia, Virginia to educate participants on utility-scale solar siting, permitting, and software design and to also learn from similar project experiences at sites in North Carolina. For more information, please visit www.vce.vt.edu/energy

Opportunities Going Forward

- Grow aspects of energy programs from multidisciplinary to interdisciplinary
- Expand upon successes of regional pilots
- Enhance sophisticated educational content to cost-effectively strengthen elements and reach of programming
- Efficiently utilize/revise evaluation data and report appropriate aspects of programs

Contact Us For More Information on These Programs

Residential Energy Efficiency: Jennifer Abel (jabel@vt.edu), Farm Energy Efficiency & Renewables: John Ignosh (jignosh@vt.edu), Dr. Martha Walker (mwalker@vt.edu), Matt Booher (mbooh@vt.edu), Youth Energy: Dan Swafford (dswafford@vt.edu), Community Planning & Development: Dr. Sarah Fogel (sfogel@vt.edu), General Questions: John Ignosh (jignosh@vt.edu)

Areas I generally work in....

Goals:

- Raise awareness among clientele of new approaches to increase the efficiency of production systems and opportunities to minimize environmental impact
- Spur appropriate adoption and application of innovations among clientele to help meet their production objectives
- Relay emerging issues expressed by clientele to research community

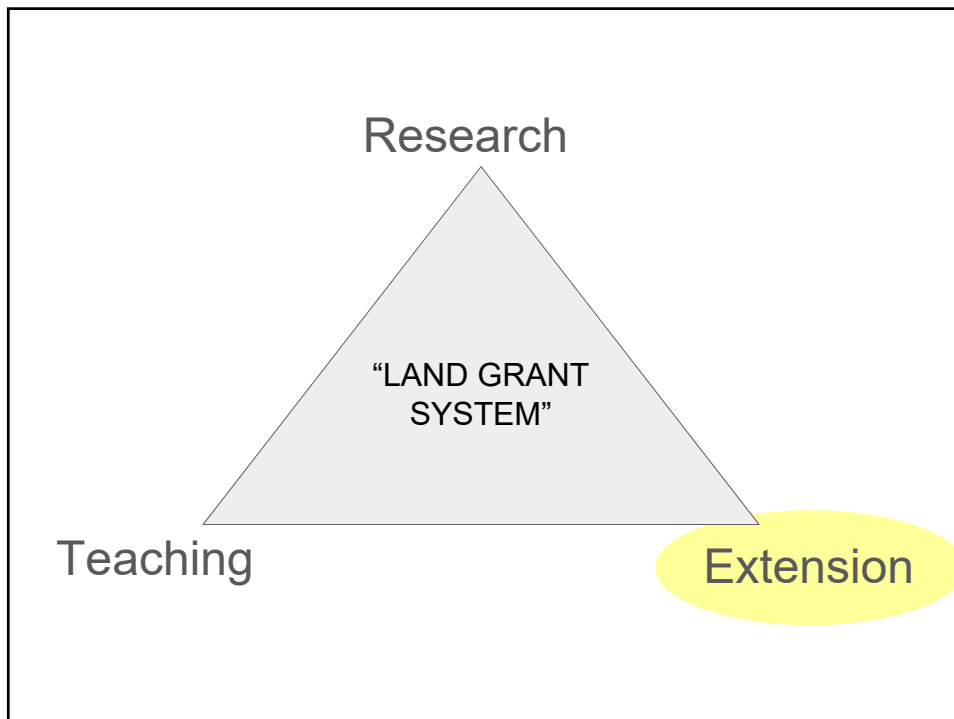
Focus Areas:

1. On-farm energy efficiency
2. Renewable energy conversion technologies
3. Project assessment tools
4. Nutrient management technologies

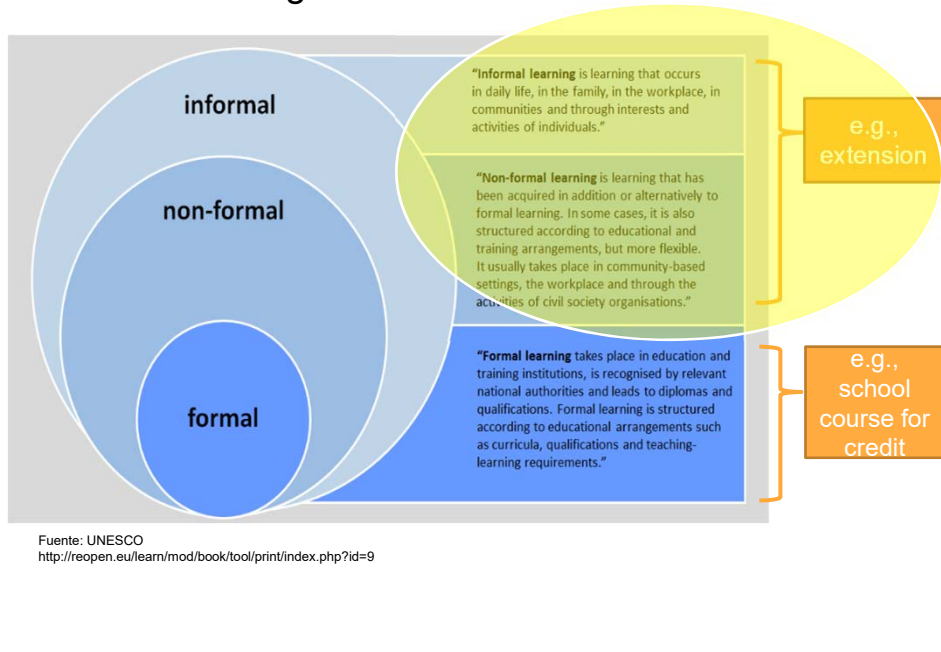


Promote the efficient utilization of agricultural byproducts. This role includes:

- Collaborating on regional efforts to assess opportunities to integrate nutrient management technologies with renewable energy generation
- Providing unbiased technical information on bioenergy conversion technologies including anaerobic digestion, biodiesel and thermal conversion processes
- Assisting farmers and rural small businesses in conducting energy assessments and audits of greenhouses, dairies, poultry farms, and other operation

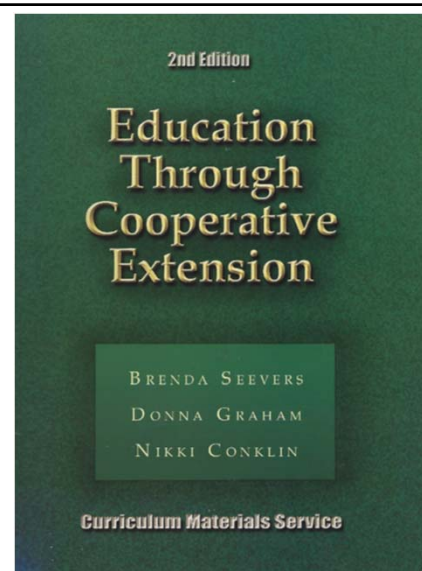


General Learning Classifications



Overview on Developing Extension Programs

- What is an "extension program"?
- **Conducting a needs assessment**
- Identifying Program Goals/Outcomes
- **Setting Program Priorities**
- Identifying Target Audiences and Capabilities
- Writing Program Objectives
- Factors Influencing Program Development
- Program Design and Implementation
- Program Evaluation
- Involving People in Program Development
- Communicating Program Plans
- Interdisciplinary Program Planning
- Ethical Issues in Program Planning
- Programming Pitfalls



Source: Seevers et al. 2007 "Education through Cooperative Extension" 2nd Edition,

Conducting Needs Assessments

- A needs assessment is a way to find “gaps” between what learners already know and what they should know (and be able to do) to achieve a certain goal
- Needs assessments often can help to: Improve program accessibility, learn more about actual conditions, identify specific needs, learn of opportunities for new programs, gauge opinion about goals, spur interest in related programs and projects

Source: Seevers et al. 2007 “Education through Cooperative Extension” 2nd Edition, Chapter 5

General Approaches:

- > Need-based (what’s missing)
- > Asset/capacity-based (build upon what there is to work with)

Example Types of Questions

- What must be improved?
- What is real cause of problem?
- Who is involved?
- What role can education play in impacting issue?
- Who supports program?
- What expertise and resources exist to address issue?
- Is this issue already adequately addressed by others?
- What other individuals and entities can assist in the effort?

Identifying Program Goals – Focus?

- The extensionist helps identify and articulate the desired end goals (what the desired changes are) are for the program, this focuses program efforts
- Goals are determined based on the context of the situation (and stakeholders), with potential input from individuals, groups, organizations, etc.
- Generally, there are 3 program categories:
 - Institutional programs
 - Informational programs
 - Developmental programs

Goal of Program	Program Examples
Institutional programming Develop basic abilities, skills, knowledge and competencies Focus on content of a discipline Goals/Objectives based on content to be transmitted	A pesticide safety education program is designed to teach content needed for individuals to pass a certification test to obtain a license to use pesticides safely. A food safety certification course for restaurant personnel focuses on the content necessary for them to practice regulations set by health departments in their restaurant.
Informational programs Information exchange between educator and learner Focus on dissemination of new information Educator determines best ways to share information based on learner preferences Learner then incorporates the information into his/her life, business, farm operation, family, etc.	Frequently asked questions and photos are on a website for clientele to diagnose and treat an insect pest on roses. A community workshop provides an overview of new tax laws influencing farm operations.
Developmental programs Focus on solving problems and/or coping strategies Goals set in partnership with learners Program custom-designed to meet specific needs	Cooperative Extension organizes school administrators, parents, teens, teachers, and community leaders to develop a local strategy to increase high school graduation rates. Extension agents and specialists work with owners of farms to address local issues impacting migrant workers.

Figure 5-4. Boyle's overview of program types (1981).

Source: Seevers et al. 2007 “Education through Cooperative Extension” 2nd Edition, Chapter 5

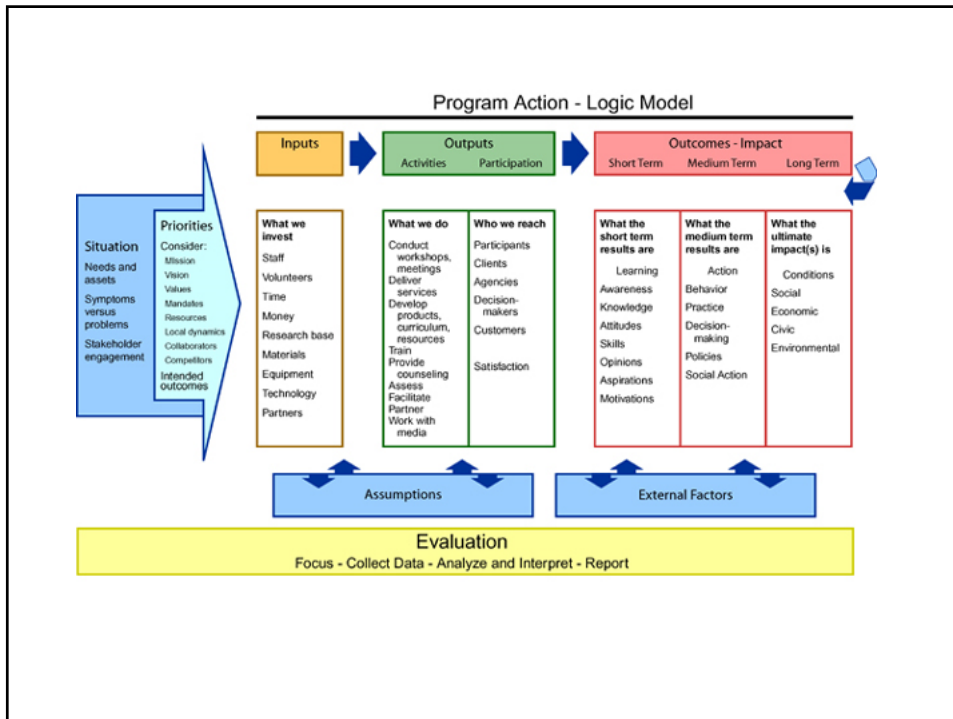
Setting Priorities – Constraints?

- Needs are often identified without a clear picture of their relative importance or ranking
- Extensionists balance pressures (internal organization, stakeholders, local clientele, political leaders, society, their individual professional goals, etc.) to constantly establish priorities throughout the programming process:
 - Defining target audiences
 - Identifying needs
 - Determining methods and strategies
 - Execution of daily activities toward program goals
- Key reasons for priority setting (Forest and Mulcahy, 1976)
 - Focuses limited resources (time, money, personnel) toward changes stakeholder needs for maximum impact
 - Enables working proactively to prevent/mitigate future problems
 - Develops credibility/accountability with stakeholders
 - Enhances well being of extensionsit (less overwhelmed by too many “opportunities”)

SAMPLE STEPS

1. Assess present situation and current scope of program activities
2. Identify priorities from needs assessments and other sources
3. Weigh importance of priorities from above
4. Reflect on consequences of acting on different opportunities (go/no-go impact, etc.)
5. Take action on priorities (e.g., refer to others, raise priority level, establish timeline, etc.)

Source: Seevers et al. 2007 "Education through Cooperative Extension" 2nd Edition, Chapter 5



Areas I generally work in....

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- Spur appropriate adoption and application of innovations among clientele to help meet their production objectives
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Focus Areas:

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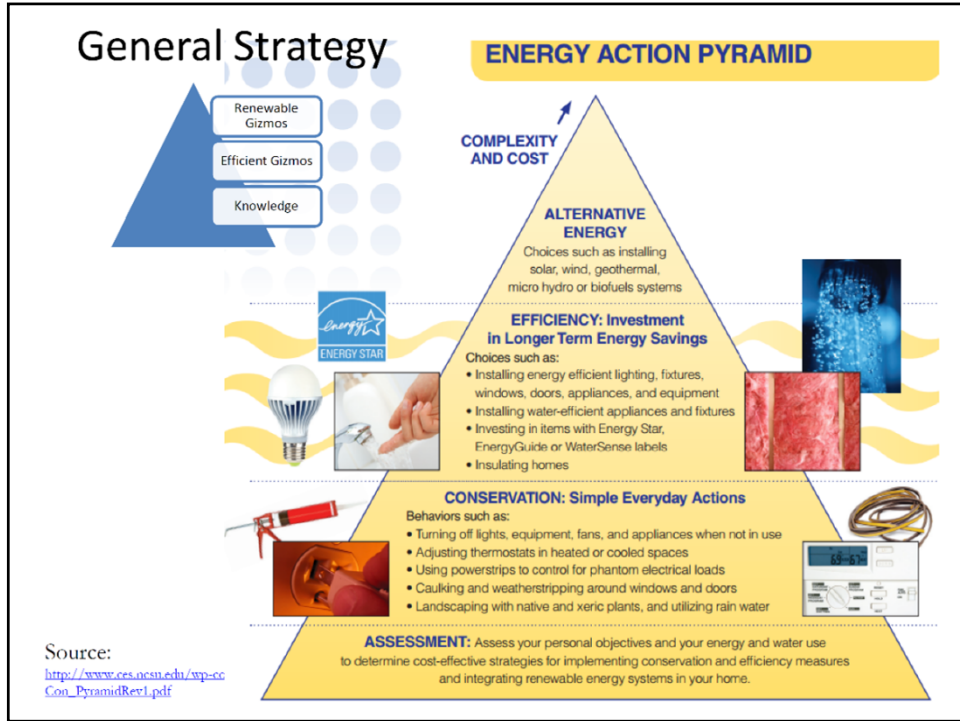
Promote the efficient utilization of agricultural byproducts. This role includes:

- Collaborating on regional efforts to assess opportunities to integrate nutrient management technologies with renewable energy generation
- Providing unbiased technical information on bioenergy conversion technologies including anaerobic digestion, biodiesel and thermal conversion processes
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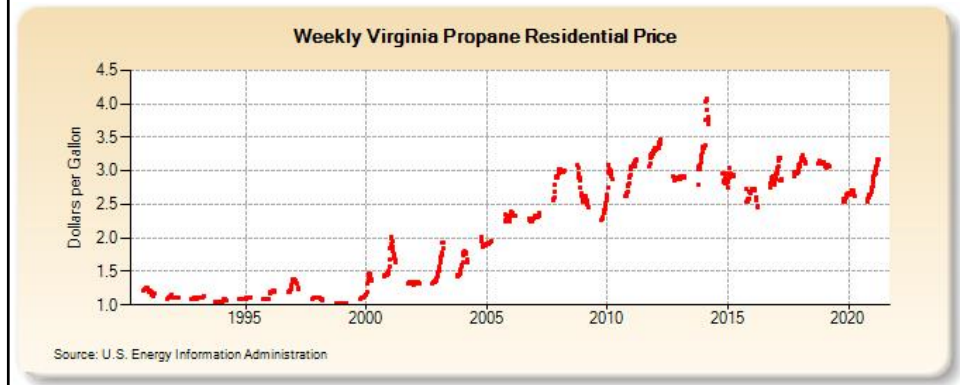
Example stakeholder engagement regarding "energy"

What are your goals?

- Examples:
 - Reduce system energy requirements
 - Reduce energy costs
 - Reduce reliance on grid-tied energy
 - Increase use of renewable energy
 - Offset grid-tied energy where possible
 - Become completely independent of grid
 - Invest a specific amount of money toward a renewable system
- System design choices and considerations for each of these could look very different
- Understanding your goals is very important



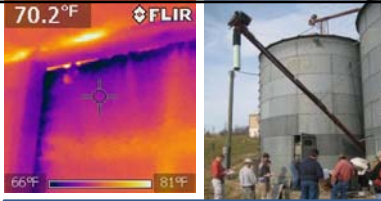
Issue: Increasing LPG prices impacting poultry producers, greenhouse growers & tobacco farmers



On-Farm Energy Efficiency Program A Pilot Program for Southside & Southwest Virginia

Virginia Tobacco Indemnification and Revitalization Commission

- According to the 2012 National Agriculture Statistical Service (NASS) report, **farm energy prices increased approximately 19% from 2007 to 2011**. It is estimated that across the 34 counties of Southside and Southwest Virginia, **farmers spent more than \$66 million in farm energy related expenses during 2011**
- A 10% increase in energy efficiency would have produced nearly \$6.6 million additional income to Virginia farms in 2011 ***But, how can we find those opportunities?***
- Farm energy efficiency program provides research-based information related to best management practices concerning energy via Virginia Cooperative Extension workshops, factsheets, webinars, etc.
- Farm energy audits to provide tailored operable information to decision maker to identify cost-effective retrofits



The seven-year Agricultural Energy Efficiency Initiative (AEEI) sponsored program was completed in December 2017. The recently completed second phase has resulted in:

- 64 completed farm energy audits identified potential annual savings of:
 - 873,968 kWh in electricity,
 - 429,847 gallons of propane,
 - 3,151 MTCO₂e greenhouse gas emissions reductions, A
 - Annual energy-cost savings of \$850,734.
 - 46% of retrofits had a payback period of less than 5 years.

Assessing Greenhouse Electrical Energy Needs for Aquaponic System

Examples of Small (8X12) and Large (30 X 96) Backyard Greenhouses



<http://www.growrevolution.com/products/growrevolution-garden-garden>



<http://www.theherlogic.com/blog/high-tunnel-greenhouse-30-x-96-x-12-ft-gothic-shape-full-ltr>

Case Study 1
Total WH/Day= 101,196

LOAD ANALYSIS		Month:		
Load Description	Qty	AC LOADS		Energy Consumption (Wh/day)
		Power Rating (W)	Operating Time (hrs/day)	
small green house 8 X12	2			
water pump	1	400	24	9600
recirculation pump	1	345	2	690
transfer pump	1	15	24	360
air pump	3	3000	8	72000
immersion heaters	5	100	12	6000
lighting (LED)	2	40	16	1280
computer controller	1	10	1	10
scales	6	200	8	9600
grow lights	1	207	8	1656
24"louvered air circulation fan				

Case Study 2
Total WH/Day= 171,992

LOAD ANALYSIS		Month:		
Load Description	Qty	AC LOADS		Energy Consumption (Wh/day)
		Power Rating (W)	Operating Time (hrs/day)	
large green house 30X90	4			
water pump	2	400	24	19200
recirculation pump	2	345	2	1380
transfer pump	2	15	24	720
air pump	5	3000	8	120000
immersion heaters	10	100	12	12000
lighting (LED)	4	40	16	2560
computer controller	2	10	1	20
scales	8	200	8	12800
grow lights	2	207	8	3312
24"louvered air circulation fan				

Bob Lane
Extension Specialist
Biological Systems Engineering
Virginia Seafood AREC

- Opportunities for efficiency?
- How might these choices affect your solar system?

LOAD ANALYSIS Month: August

AC LOADS

Load Description	Qty	Power Rating (W)	Operating Time (hr/day)	Energy Consumption (Wh/day)
Refrigerator/Freezer	1	200	10	2000
Microwave	1	1200	0.5	600
Toaster	1	1000	0.05	50
Coffeemaker	1	600	0.25	150
Washing Machine	1	800	0.29	232
Entertainment Center	1	200	3	600
Computer System	1	100	2	200
Plug Loads	1	200	1	200
Water Pump	1	800	0.33	264
Ceiling Fans	2	50	24	2400
Fluorescent Lighting	4	15	6	360
Fluorescent Lighting	4	32	4	512

DC LOADS

Total AC Power: 5388 W
 Total DC Power: 0 W
 Total Daily AC Energy Consumption: 7568 Wh/day
 Total Daily DC Energy Consumption: 0 Wh/day
 Weighted Operating Time: 11.2 hr/day
 Inverter Efficiency: 0.90
 Average Daily DC Energy Consumption: 8409 Wh/day

Source: 2010. Dunlop, J. Photovoltaic Systems, Second Edition. NJATC, American Technical Publishers, Inc.

Assessing Thermal Energy Needs of Horticultural Structures (Low/Hi Tunnels)

ICTAS, VSU (Dr. Rafie & C. Mullins), SPES (Dr. Welbaum, C. Galanopoulos & BSE (Dr. Arogo; J. Ignosh)

Extending the Growing Season of High-Value Crops using Innovative Renewable Energy Systems

Abstract
 System designers in all climates experience the most customer demand during periods of reduced market availability of locally grown warm season vegetables. Renewable energy sources have appeal for their small footprint footprint of their physical and environmental impact. This experiment compares the efficiency of both direct and indirect solar and geothermal technologies to both low tunnels for production of warm season crops and low in fall. These treatments include a bare plot, a floating bed, a low tunnel, a low tunnel with an earth bank heat production tank, a low tunnel passive heated water tank, and a low tunnel with a solar heated water tank. While the trial is still ongoing, preliminary results show that the floating cover provides the highest energy use of warm season crops within the treated area.

Annual Sum of Tunnel BTU Usage per Condition

Exploring Some Differences:
 Material Type?
 Quality of Insulation?
 Current Condition/Maintenance?

Virtual Grower Tool
 Free Tool from USDA ARS

Comparison: Double Poly (Ideal) vs. Single Poly (Worst)
 ➤ Single Poly: 460,024,885 BTU/yr
 ➤ Double Poly: 244,732,785 BTU/yr
 ➤ ~53% of thermal energy needs of single poly only
 ➤ 215,292,100 BTU/yr in ENERGY SAVINGS.
 ➤ Approximately 2,352 gallons propane (@\$1.50/gallon = \$3528/yr)

<http://www.virtualgrower.net/>

Additional Resources

- Greenhouse Heating Video, An overview of greenhouse heating design considerations by Dr. A.J. Both, Associate Extension Specialist, Department of Environmental Sciences, Rutgers University.
 - <https://youtu.be/8iZsrpNTvp4>

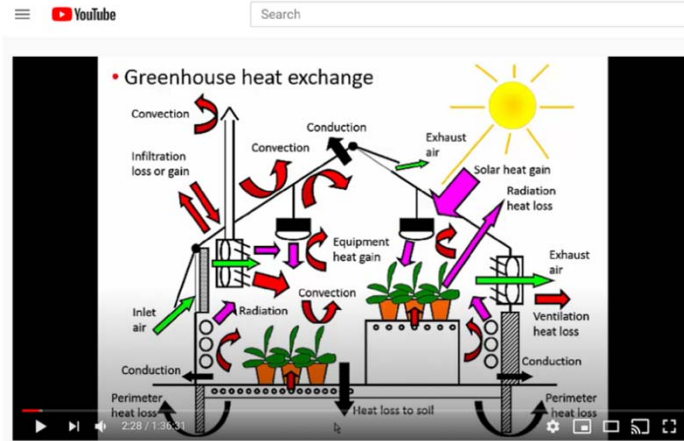


Table 1: Summary of Energy Improvements (Examples of recommended measures shown.)

Recommended Measure	Estimated Annual Reduction in Energy Use				Estimated Costs, Savings, Payback, and Prioritization for Implementation				
	Electric Savings (kWh)	Natural Gas Savings (cf)	Propane Savings (gal)	Other ^a	Energy Savings (MMBtu)	Installed Cost [a]	Annual Cost Savings [b]	Payback in Years [a/b]	Est. Life in Years
Lighting	25,210				86	\$1,740	\$2,094	0.8	7
Seal Air Leaks			477		44	\$1,500	\$809	1.9	8
Insulate Brood Curtains			98		9	\$450	\$167	2.7	10
Exposed Foundation									
Wall Insulation			383		35	\$5,621	\$651	8.6	20
Curtain to Solid Insulated Sidelights			442		41	\$7,168	\$754	9.5	20
Totals:	25,210		1,400		215	\$16,479	\$4,475	3.7	

Sources:
<https://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/programs/financial/eqip/?cid=stetprdb1046252>
https://www.nrcs.usda.gov/wps/PA_NRCSConsumption/download?cid=stetprdb1264606&xt=pdf

Energy Audits USDA - NRCS


EQIP On-Farm Energy Initiative

On-farm Energy Initiative

The Environmental Quality Incentives Program (EQIP) On-Farm Energy Initiative helps farmers and ranchers make voluntary improvements that can boost energy efficiency on the farm. This emerging agricultural trend produces benefits, including reduced input costs, increased productivity per unit of energy consumed by equipment and lighting, and reduced air pollutants and greenhouse gas emissions caused when energy is generated for agricultural use.

Financial assistance is available to inventory and analyze farm systems that use energy and identify opportunities to improve efficiency through the development of an Agricultural Energy Management Plan (AgEMP). The AgEMP, or energy audit, is completed by NRCS-certified Technical Service Providers (TSPs) and provides:

- Baseline energy use by individual systems to establish a baseline for electricity and other fuel improvements,
- Recommendations for equipment improvements and upgrades,
- Potential energy reductions and financial savings for each recommendation
- Cost estimates of potential improvements, and
- Length of expected payback for energy efficiency upgrades



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Publication 442-881

Biomethane Production Technology

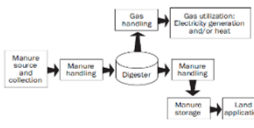
Jacome Arago Ogayo, Extension Specialist, Biological Systems Engineering, Virginia Tech
John Igouash, Extension Specialist, Biological Systems Engineering, Virginia Tech
Eric Benfield, Extension Specialist, School of Plant and Environmental Sciences, Virginia Tech

Purpose

This publication provides a general overview of anaerobic digestion and the current status of biomethane technology on livestock farms in the United States. Most of the discussion uses dairy manure as an example of feedstock for an anaerobic digester. Resources which provide more detailed information on anaerobic digesters are listed.

Biogas Technology

Biomethane (biogas) is an alternative and renewable energy source produced through the anaerobic (oxygen free) digestion of organic matter whereby the organic matter is converted into a combustible biogas rich in methane (CH₄) and a liquid effluent (Figure 1). In general, biogas consists of 55 percent to 80 percent methane and 20 percent to 45 percent carbon dioxide (CO₂). However, depending on the source of the organic matter and the management of the anaerobic digestion process, small amounts of other gases such as ammonia (NH₃), hydrogen sulfide (H₂S), and water vapor (H₂O) may be present. It is the methane component of the biogas that will burn or produce energy. The gas can be used to generate heat or electricity or both. It can be burned in a conventional gas boiler to produce heat for nearby buildings or to heat the digester, or used in a gas engine to produce electricity. As the organic material (feedstock) is added to the system, the digested effluent is pumped from the digester. The effluent can be stored in a tank and later applied to the land at an appropriate time as a fertilizer without further treatment. Or, the effluent can be separated into solids (fiber) and liquids. The solids can be composted prior to sale for use as a compost or animal bedding. The liquid still contains



```

    graph LR
      A[Manure source and collection] --> B[Manure handling]
      B --> C[Digester]
      C --> D[Manure handling]
      C --> E[Gas handling]
      E --> F[Gas utilization: Electricity generation and/or heat]
      D --> G[Manure storage]
      G --> H[Land application]
    
```

Figure 1. Basic material flow in an anaerobic digestion system.

Sources of organic matter that have been used to produce biogas include animal manure, sewage sludge, municipal solid waste, food-processing wastes, and industrial wastes.

A typical biogas system consists of manure collection, anaerobic digestion, storage for digester effluent, and gas handling and gas use equipment (Figure 2).

Anaerobic digesters have been used successfully in municipal and industrial wastewater treatment plants and on a number of livestock farms for many years. However, the use of anaerobic digestion technology on livestock farms in the U.S. for manure treatment and energy production has increased over the past few years. According to the EPA AgStar program, some of the factors influencing the increased demand for anaerobic digesters are increasing technical reliability of anaerobic digesters through the deployment of successful operating systems; growing concern of farm owners about environmental quality; increasing man-

Produced by Virginia Cooperative Extension, Virginia Tech, 2016

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Additional Resources



What's it like to apply for Farm Incentive Programs like REAP?

ENERGY ANSWERS

<https://farm-energy.extension.org/energy-answers-for-the-beginning-farmer-and-rancher/>

Additional Resources

- Photovoltaic (PV) Modules “Panels”
 - Generate Electricity



<https://youtu.be/73wZPcz9c70>

- Solar Thermal/Hot Water (SHW) Collectors
 - Generate hot water



<https://youtu.be/JUJvbM1YPSA>

[Can you lower energy costs for field crop production?](#)

[How to choose a feedstock for pellet making?](#)

[Energy efficient LEDs and long day lighting for dairy](#)

[How to control energy use and cost?](#)

[How to grow greenhouse crops sustainably?](#)

[Can I use biodiesel in farm diesel engines?](#)

[Where can I find money to implement energy efficiency measures?](#)

[How do I make pellets on the farm?](#)

[How to determine pellet durability?](#)

[How can you compare heating costs of different fuels?](#)

[How can I save on the cost of grain drying?](#)

[How to select LED lights for agriculture?](#)

[Why do an energy audit on your farm?](#)

[Is wood heat right for you?](#)

[How can proper livestock ventilation save energy & feed?](#)

[What is it like to apply for farm energy incentive programs like REAP?](#)

[How to choose a heating fuel?](#)

[How to save money by understanding your electric bill?](#)

[How to choose proper livestock ventilation fans?](#)

[How do I size a cooler for on-farm produce storage?](#)

[How to design an energy efficient hydroponic system?](#)

<https://farm-energy.extension.org/energy-answers-for-the-beginning-farmer-and-rancher/>

Additional Resources



<https://farm-energy.extension.org/energy-answers-for-the-beginning-farmer-and-rancher/>



United States Department of Agriculture
National Institute of Food and Agriculture



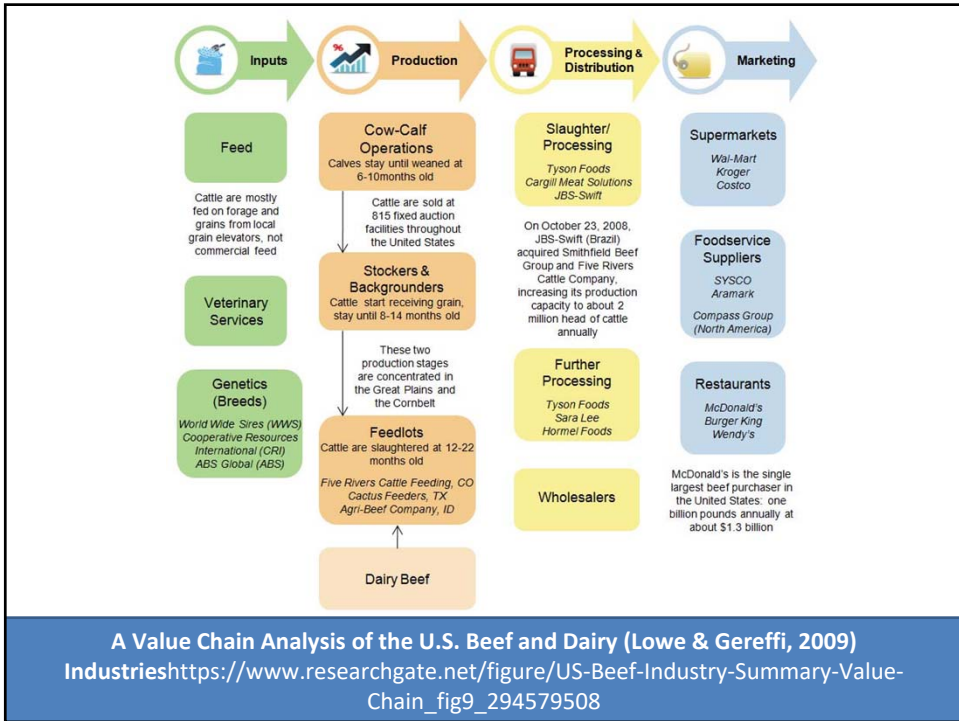
Additional Resources

[Home](#)
[Programs](#)
[Resources](#)
[Services](#)
[Help/Support](#)
[About Us](#)
[Contact Us](#)
Try Solar Calculator

DSIRE Insight

Programs	Overview	Summary Maps	Summary Tables	News
Net Metering	VA	Regulatory Policy	Net Metering	01/01/2000 11/16/2018
Guidelines for Solar and Wind Local Ordinances	VA	Regulatory Policy	Solar/Wind Permitting Standards	06/21/2011 10/12/2018
Qualified Energy Conservation Bonds (QECBs)	US	Financial Incentive	Loan Program	10/23/2008 08/22/2018
USDA - Rural Energy for America Program (REAP) Loan Guarantees	US	Financial Incentive	Loan Program	04/09/2003 08/21/2018
USDA - Rural Energy for America Program (REAP) Grants	US	Financial Incentive	Grant Program	04/09/2003 08/21/2018
USDA - Rural Energy for America Program (REAP) Energy Audit and Renewable Energy Development Assistance (EA/REDA) Program	US	Financial Incentive	Grant Program	02/18/2015 08/21/2018
Modified Accelerated Cost-Recovery System (MACRS)	US	Financial Incentive	Corporate Depreciation	03/15/2002 08/21/2018
Green Power Purchasing Goal for Federal Government	US	Regulatory Policy	Green Power Purchasing	02/19/2004 08/21/2018
Energy Goals and Standards for Federal Government	US	Regulatory Policy	Energy Standards for Public Buildings	06/19/2006 08/21/2018

<https://www.dsireusa.org/>



Solar-Powered Livestock Watering Systems: Evaluating System Options for Use in Freeze-free Months for Farmers on Rented Ground with Short-term Leases (M. Booher, A. Horn, G. Pent, J. Ignosh)



To meet the goals of the Chesapeake Bay TMDL, Virginia's Watershed Implementation Plan II sets forth a series of sector-specific best management practices (BMPs) to improve water quality. The BMP for pasture fencing is targeted to increase by 102M feet of pasture fencing by the year 2025. Fencing may require alternative livestock watering systems. Access to grid-tied electrical power may present itself as a cost-effective option to meet farm water pumping needs. However, for other locations the cost to extend the electrical grid to power a small water pump may prove prohibitive. Furthermore, the installation of capital intensive and/or cost-shared livestock watering improvements can be problematic on rented acreage. Portable solar-powered water pumping systems may be a viable option among farmers.

INTRODUCTORY WEBINAR: Solar-Powered Water Pumping Systems for Livestock: Some Experiences & Considerations for Moveable Systems
 Tuesday, November 10th, 2020 10AM-11AM



Please join us for a brief introductory informational webinar on solar-powered water pumping systems for livestock. For a variety of reasons, many farmers are exploring ways to fence-out livestock from streams, providing alternative off-stream water sources can be a challenge, especially on leased acreage, among other factors. Moveable solar-powered water pumping systems for use in freeze-free months may serve as an additional management alternative for farmers to consider in managing some of these locations.

- | | |
|---|--|
| Topics <ul style="list-style-type: none"> Management Factors System Components Siting Considerations Operational Experiences Q/A / Discussion | Presenters <ul style="list-style-type: none"> System Operators: Bob Bagley, North Mountain Cattle Company & Dr. Gabe Post, Shen Valley AREC/ATP Virginia Cooperative Extension: Matt Booher, Rockingham/VCE & John Ignosh, Biological Systems Engineering/VCE |
|---|--|

REGISTER FOR THIS FREE WEBINAR AT THE BELOW LINK:
<https://www.vce.vt.edu/extension/programs/2020/11/10/solar-water-pumping/>



Using Remotely Sensed Lidar Data to Assist in Design and Siting Considerations for Transportable Solar-Powered Water Pumping Stations for Alternative Livestock Watering Systems in the Chesapeake Bay Watershed

Webinars & Workshops on Energy Project Decision Support Tools



Introduction to RETScreen Expert
 Thursday, May 25, 2017 from 10AM-11:30AM (EST)

FREE EDUCATIONAL WEBINAR

What is RETScreen EXPERT?

RETScreen is a Clean Energy Management Software system for energy efficiency and renewable energy project feasibility analysis as well as ongoing energy performance analysis. RETScreen Expert, an advanced premium version of the software, is available in Viewer mode completely free of charge. The platform is developed by the Natural Resources Canada, of the Canadian Government. [source: www.nrc.ca]

Who Should Attend This Introductory Webinar?

If you are interested in learning more about the features of this tool, please join us for this introductory webinar.

During the session, RETScreen training expert, Michael Ross of RER Energy, Inc., will focus on feasibility analysis, but also provide an overview of all of RETScreen Expert's various modules and applications, including:

- Virtual Energy Analyzer
- Risk Analysis
- Benchmark Analysis
- Feasibility Analysis
- Performance Analysis
- Portfolio Analysis



Experienced Expert Trainer: Michael Ross, RER Energy, Inc.

Mr. Ross has worked with renewable energy systems and other clean energy technologies for over 20 years. Michael has held research positions with Carnet ENERGY and the Advanced Energy Systems Group of the Department of Technical Physics and Mathematics at Aalto University, Finland's premier engineering university. RER Energy Inc. is a consultancy focused on energy efficiency and renewable energy. Its main activity is research on system-level topics, including system optimization, component and system characterization, resource assessment, simulation, modeling, and data analysis.

If you are a person with a disability and desire any assistive devices, services or other accommodations to participate in this activity, please contact John Ignosh, VCE Northern District Office at 540-432-6029/TDD or during business hours of 8 a.m. and 5 p.m. to discuss accommodations 5 days prior to the event. *TDD number is (800) 828-1120.



A Brief Introduction to Solar Photovoltaic Investment Analysis & the 'System Advisor Model' (SAM) Decision Support Tool

Friday, November 17, 2017 from 10:30AM-11:30AM (EST)

FREE EDUCATIONAL WEBINAR

Webinar registration required, please sign up at this link:

<https://www.vce.vt.edu/extension/programs/2017/11/17/solar-photovoltaic-investment-analysis/>

Please consider joining us for a brief 1-hour introductory webinar on solar photovoltaic project investment analysis. This session will highlight some of the key aspects to consider when exploring solar energy projects, including:

- | | |
|--------------------------------------|---------------------------------|
| Estimating System Production | Understanding Incentives |
| Assessing System Cost | Conducting a Financial Analysis |
| Forecasting the Value of Electricity | And more! |

Additionally, the session will also introduce the System Advisor Model (SAM) which "... makes performance predictions and cost of energy estimates for grid-connected power projects based on installation and operating costs and system design parameters that you specify as inputs to the model. Projects can be either on the customer side of the utility meter, buying and selling electricity at retail rates, or on the utility side of the meter, selling electricity at a price negotiated through a power purchase agreement (PPA). [source: www.nrel.gov] SAM is a freely available decision support tool developed by the U.S. Department of Energy's National Renewable Energy Lab.



The webinar will also include information on additional educational resources on solar investment analysis and SAM, and for an in-person workshop on these same topics scheduled for December 11-14, 2017 in Danville, VA as part of the Agricultural Energy Efficiency Initiative funded by a grant from the Virginia Tobacco Indemnification and Revitalization Commission, with co-sponsorship from VA Dept. Mines, Minerals & Energy

Webinar Presenters:

- Eric Romick, The Ohio State University
- John Hay, University of Nebraska
- Paul Gilman, US Department of Energy, NREL SAM Trainer
- John Ignosh, Bio Sys Eng., Virginia Cooperative Extension

Series Collaborators & Sponsors:



If you are a person with a disability and desire any assistive devices, services or other accommodations to participate in this activity, please contact John Ignosh, VCE Northern District Office at 540-432-6029/TDD or 828-1120 during business hours of 8 a.m. and 5 p.m. to discuss accommodations 5 days prior to the event.

Solar Resource

Solar Window

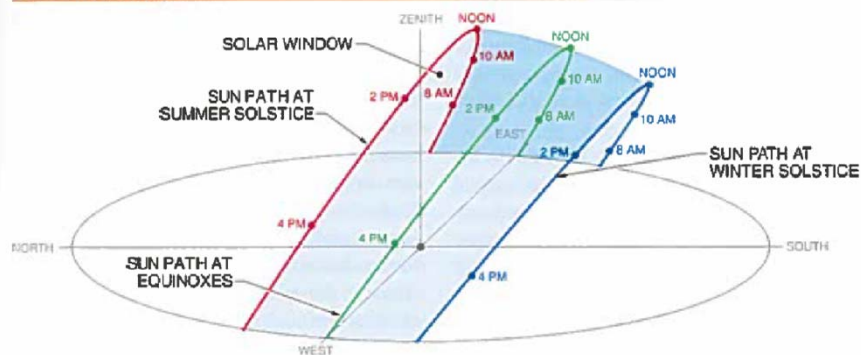


Figure 2-27. The solar window is the area of sky containing all possible locations of the sun throughout the year for a particular location.

Source: 2010. Dunlop, J. Photovoltaic Systems, Second Edition. NJATC, American Technical Publishers, Inc.

Array Orientation

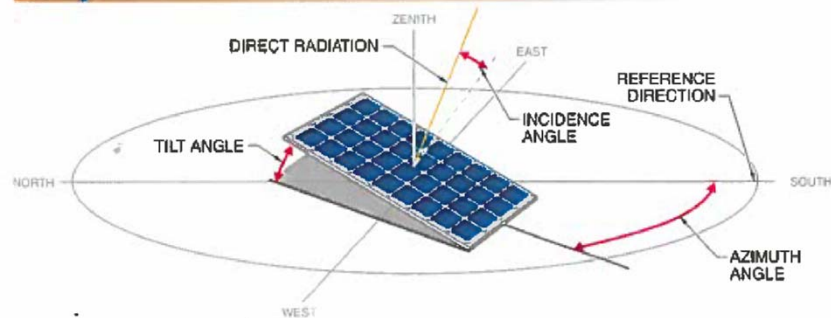


Figure 2-28. Array orientation can be described using azimuth and tilt angles.

Considerations for tilt angle:

- Variations in annual load profile? Optimize tilt for max load?
- Solar Window & Latitudes
 - Alaska? Virginia? At Equator?

Source: 2010. Dunlop, J. Photovoltaic Systems, Second Edition. NJATC, American Technical Publishers, Inc.

- Irradiance (W/m²)
- Insolation or Peak sun hours (kWh/m²/ day)

On average, how sunny is it for a region in a particular month? (long-term averages, think "climate" not "weather")

Peak Sun Hours

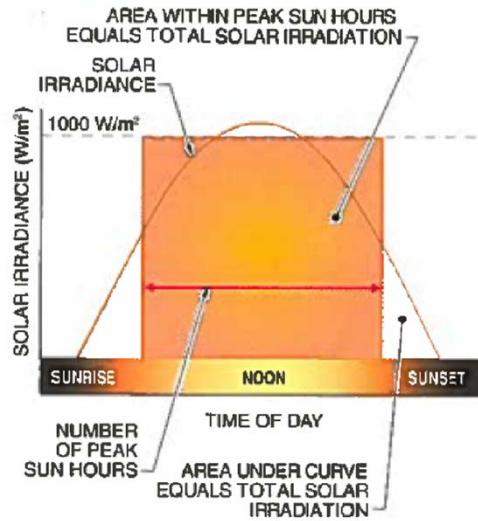
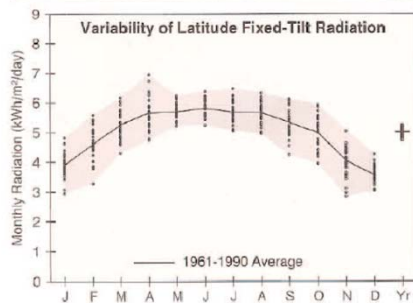


Figure 2-10. Peak sun hours is an equivalent measure of total solar irradiation in a day.

Source: 2010. Dunlop, J. Photovoltaic Systems, Second Edition. NJATC, American Technical Publishers, Inc.



Lynchburg, VA

WBAN NO. 13733

LATITUDE: 37.33° N
 LONGITUDE: 79.20° W
 ELEVATION: 279 meters
 MEAN PRESSURE: 984 millibars

STATION TYPE: Secondary

Solar Radiation for Flat-Plate Collectors Facing South at a Fixed Tilt (kWh/m²/day), Uncertainty ±9%

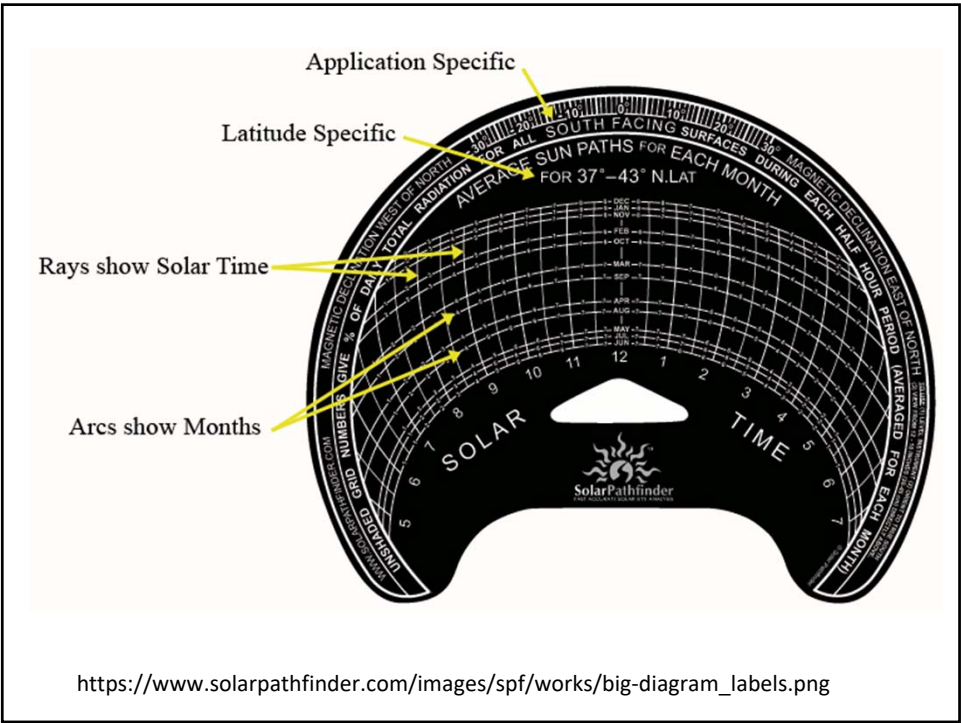
Tilt (°)		Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Year
0	Average	2.4	3.2	4.3	5.4	6.0	6.5	6.2	5.6	4.7	3.7	2.6	2.1	4.4
	Min/Max	2.0/2.7	2.6/3.7	3.7/4.9	4.0/6.5	5.5/6.6	5.8/7.1	5.5/7.0	5.0/6.2	3.9/5.2	3.2/4.3	2.0/3.0	1.9/2.3	4.2/4.5
Latitude -15	Average	3.4	4.2	5.1	5.8	6.1	6.3	6.1	5.9	5.3	4.6	3.6	3.1	5.0
	Min/Max	2.7/4.1	3.1/5.0	4.2/5.9	4.8/7.1	5.5/6.6	5.7/6.9	5.4/7.0	5.2/6.5	4.3/6.0	3.8/5.5	2.6/4.4	2.7/3.6	4.7/5.2
Latitude	Average	3.9	4.6	5.3	5.7	5.7	5.8	5.7	5.7	5.3	5.0	4.0	3.6	5.0
	Min/Max	2.9/4.8	3.3/5.6	4.3/6.2	4.7/6.9	5.2/6.2	5.3/6.4	5.1/6.5	5.0/6.3	4.2/6.1	4.0/5.9	2.8/5.1	3.0/4.3	4.7/5.2
Latitude +15	Average	4.2	4.8	5.2	5.3	5.1	5.0	5.0	5.2	5.1	5.0	4.3	3.8	4.8
	Min/Max	3.1/5.2	3.3/5.8	4.2/6.1	4.4/6.5	4.6/5.5	4.6/5.5	4.4/5.7	4.5/5.8	4.0/5.9	3.9/6.0	2.9/5.4	3.2/4.6	4.5/5.0
90	Average	3.8	4.0	3.7	3.2	2.6	2.4	2.5	2.9	3.4	4.0	3.7	3.5	3.3
	Min/Max	2.6/4.9	2.7/4.8	3.0/4.5	2.7/5.8	2.4/2.8	2.2/2.5	2.3/2.7	2.6/3.2	2.7/4.0	3.0/4.8	2.5/4.8	2.9/4.3	3.1/3.5

<http://rredc.nrel.gov/solar/pubs/redbook/PDFs/VA.PDF>

Solar Pathfinder



Source: <https://www.solarpathfinder.com>






PV WATTS

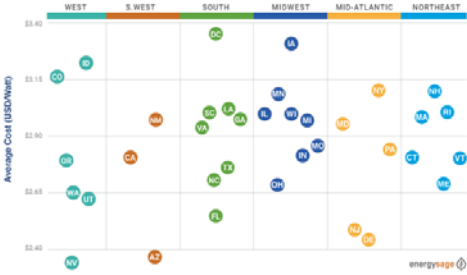
DEMO

Month	Solar Radiation (kWh / m ² / day)
January	2.84
February	3.36
March	4.03
April	4.76
May	5.08
June	5.18
July	5.14
August	5.11
September	4.65
October	4.29
November	2.84
December	2.35
Annual	4.14

<http://pwwatts.nrel.gov/pwwatts.php>



COMPARE SOLAR PRICES ONLINE & SAVE



SYSTEM SIZE	AVERAGE SOLAR PANEL SYSTEM COST* (BEFORE TAX CREDITS)	AVERAGE SOLAR PANEL SYSTEM COST* (AFTER TAX CREDITS)
2 kW	\$5,620	\$4,159
3 kW	\$8,430	\$6,288
4 kW	\$11,240	\$8,318
5 kW	\$14,050	\$10,397
6 kW	\$16,860	\$12,476
7 kW	\$19,670	\$14,556
8 kW	\$22,480	\$16,635
9 kW	\$25,290	\$18,715
10 kW	\$28,100	\$20,794
12 kW	\$33,720	\$24,953
15 kW	\$42,150	\$31,191
20 kW	\$56,200	\$41,588
25 kW	\$70,250	\$51,985

*These prices reflect the cost of a solar energy system both before AND after deducting the federal solar tax credit (known as the ITC), which reduces your solar system cost by 26 percent. Some states, local governments, and utilities also offer rebates and other tax incentives.

PAY CASH
Own the system; maximize savings


Pay for a turnkey system; Government incentives cover 30% - 50% of the cost.

\$15,000 20 Year Net Savings ☺

\$13,000 Net Cost ☺

10 Years Payback

3% or more Increase in Property Value ☺



\$0-DOWN LOAN
Own the system; no up-front cost


Quality for government incentives; interest may be tax deductible.

\$7,400 20 Year Net Savings ☺



\$0 Out-of-Pocket Cost

Immediate Payback

3% or more Increase in Property Value ☺




Sources: <https://www.energysage.com>

Solar Project Financial Analysis & System Advisor Model (SAM): Webinar and Workshop

Solar Photovoltaic Investment Analysis & DOE NREL's 'System Advisor Model' (SAM) Decision Support Tool
December 13th & 14th 9AM - 5PM
The Institute for Advanced Learning and Research
150 Slayton Avenue Danville, VA 24540

Solar photovoltaic (PV) project development is expanding throughout Southside and Southwestern Virginia. Projects are being developed at a variety of scales and clientele are evaluating variety of project types with each raising a variety of questions confounding efficient project exploration and raising project uncertainty. The situation can further be confounded by utility interconnect and billing impact uncertainty, among other factors. While renewable energy projects often represent a significant capex by the owner, relatively smaller projects often lack an independent feasibility study accounting for projected project costs, benefits, performance and uncertainty. Instead, capex decisions may be made based on vendor-supplied information alone, which itself may not fully convey projected project costs, benefits, performance, and uncertainty (e.g., grant success, standby charges, net-metering credit reconciliation, tax implications, etc.). In response, a webinar and a two-day workshop were held to raise awareness and understanding of key considerations of solar PV project investment analysis, and provide a hands-on introduction to the freely available, and validated, System Advisor Model (SAM) energy project decision support tool developed by DOE-NREL (Department of Energy - National Renewable Energy Laboratory). The objectives of these events were to introduce participants to the primary components of solar PV project analysis, and receive an orientation on the steps involved with conducting the analysis via the SAM tool. The workshop was supported by the AEEI program, which is funded by the Virginia Tobacco Indemnification and Revitalization Commission with additional support from Virginia Department of Mines, Minerals and Energy.

Collaborators & Sponsors:

Virginia Cooperative Extension
 Virginia Tech • Virginia State University

	Proposal 1	Proposal 2	Proposal 3
System Size (kW)	9.848	11.777	7.927
kilowatts to watts	9,848	11,777	7,927
Direct Capital Cost	\$16,600	\$18,300	\$14,600
Indirect Capital Cost	\$11,500	\$10,900	\$13,000
Total Installed Cost	\$28,100	\$29,200	\$27,600
Installed Cost Per Watt (Pre-Incentive)	2.85	2.48	3.488

Sources: <https://extensionpubs.unl.edu/publication/9000018244809/solar-electric-investment-analysis-ec3008/>
<https://aeeibse.wp.prod.es.cloud.vt.edu/solar-project-financial-analysis-system-advisor-model-sam/>

Assessment to Inform Design for Irrigation System Assessment Workshop

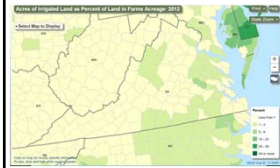


JUSTIFICATION:

The Ag Energy Efficiency Initiative (AEEI) program focuses on identifying appropriate energy-cost saving opportunities for producers in Southside and Southwest Virginia. The program uses energy efficiency as a basis for minimizing production costs, and prior to adopting renewable energy conversion technologies. Farm energy audits are conducted to meet NRCS and USDA-RD "REAP" criteria, and based on the ASABE S612 Standard "Performing On-farm Energy Audits" posted at: https://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcs142p2_007593.pdf

According to a USDA 2013 Irrigation Survey, the AEEI eligible counties of Southside (blue counties highlighted in map below) have relatively higher rates of irrigated land

AEEI Eligible Counties: http://www.aeei.bse.vt.edu/?page_id=14



USDA 2013 Irrigation Survey: https://www.agcensus.usda.gov/Publications/2012/Online_Resources/Farm_and_Ranch_Irrigation_Survey/iris13.pdf

The AEEI program, with Phase II in its final year (2017), has provided educational workshops dealing with many of the major activities described in Table 1 of ASABE S612, by farm type (e.g., lighting efficiency in poultry houses, etc.) and also on how to perform an on-farm assessment. However, so far, no workshop content has focused on irrigation systems nor on their proper assessment, a potential need as indicated by the USDA 2013 irrigation survey data (above map).

OBJECTIVES:

- Participants to gain hands-on experience (field and classroom) regarding best practices for assessing performance of more common irrigation systems in Southside VA, with emphasis on identifying energy efficiency-related improvement opportunities (fairly broad scope as it can include management (when to irrigate? How much to irrigate?), measurement (how much did I irrigate? How much did I actually irrigate?), components (could I improve efficiency by system modifications?), etc.)
- Introduce participants to appropriate research-based resources (factsheets, decision support tools) and contacts for future irrigation-related work
- Network collaboration and capacity building to provide best available resources to clientele

TARGET AUDIENCE:

- Southside and Southwest Virginia
- "Train-the-Trainer", in this case agency (USDA, Extension, etc.) personnel and service providers (Technical Service Providers, equipment vendors, etc.)
- End-users (farmers with systems, farmers considering systems)



IRRIGATION SYSTEM ASSESSMENT WORKSHOP

9:00 AM to 5:00 PM - Tuesday, August 22, 2017
Virginia Tech Southern Piedmont Agricultural Research and Extension Center (AREC)
2375 Davills Road, Blackstone, VA 23824



Please join us for a workshop exploring irrigation system assessments. This workshop is offered as part of the [Ag Energy Efficiency Initiative](https://www.aeei.bse.vt.edu/) which is a program funded by a 2014 grant from the Virginia Tobacco Indemnification and Reclamation Commission and is supported by Virginia Cooperative Extension's Community Viability and Biological Systems Engineering Department.

This event will be held at the Virginia Tech Southern Piedmont Agricultural Research and Extension Center (AREC), directions are available at: <https://www.vt.edu/locations/extension/arec/> and the address is Virginia Tech Southern Piedmont Agricultural Research and Extension Center (AREC), 2375 Davills Road, Blackstone, VA 23824.

Workshop Content & Format: The workshop will feature a mix of presentations and in-field irrigation assessment activities – please come prepared to get a bit muddy! We'll begin with background information on irrigation management practices, system assessment techniques, overview of USDA financial and technical assistance programs related to improving irrigation, and highlight decision support tools. Then, we'll hop in tractor-pulled wagons for a brief tour of the Virginia Tech Southern Piedmont Agricultural Research and Extension Center while in route to our hands-on irrigation system assessment activities. After getting both knowledge and muddy in the field, we'll head back to the classroom to review how the assessed data is analyzed and interpreted in management decisions.

Registration Information: Registration is required and space is limited. Participants may register online at this [link](https://www.vt.edu/locations/extension/arec/). Or by calling (540) 292-5331 AND sending a check for \$10 made out to "Treasurer of Virginia Tech" via mail to Virginia Tech Southern Piedmont Agricultural Research and Extension Center (AREC), 2375 Davills Road, Blackstone, VA 23824, please note in the check memo: "Irrigation Workshop". The check must be received by August 15, 2017. A lunch will be provided. Please indicate any dietary restrictions during registration.

General Workshop Agenda:

- 9AM – Morning Presentations
- 12PM – Lunch (included)
- 1PM – Field Assessment Work
- 3PM – Assessment Analysis & Afternoon Presentations
- 5PM – End of Workshop

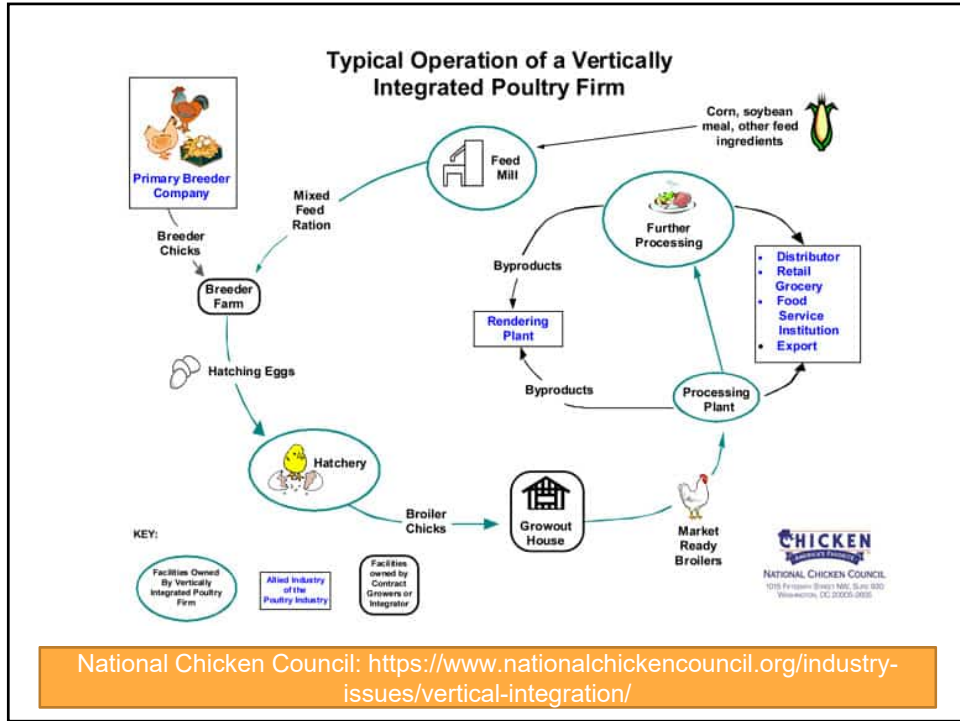
Workshop Presenters:

- Mr. Don McMoran, Washington State University
- Mr. Moneim Mohamad, Washington State University
- Dr. Hamid Farhanji, Acting National Water Management Engineer, USA-NRCS
- Ms. Laurette Tucker, VA-USDA Rural Development
- Mr. Derek Hancock, District Conservationist, VA-NRCS
- Mr. Sam Kimmel, Area Engineer, VA-NRCS
- Dr. David Reed, Extension Agronomist-Tobacco, Southern Piedmont Agricultural Research and Extension Center, Virginia Tech
- Dr. Julie Shorridge, Extension Specialist, Biological Systems Engineering, Virginia Tech & Extension
- Mr. Mike Pappas, Virginia Cooperative Extension
- Mr. John Iginosh, Area Specialist, Biological Systems Engineering, Virginia Cooperative Extension

Notice: If you are a person with a disability and desire any assistive devices, services or other accommodations to participate in this activity, please contact John Iginosh at 2322 Blue Stone Hills Drive Herndonburg, VA 22801 at (540)432-4629/ TDD number is 800-828-1110 during business hours of 9 a.m. and 5 p.m. to discuss accommodations 5 days prior to the event. Virginia Cooperative Extension programs and employment are open to all, regardless of age, color, disability, gender, gender identity, gender expression, national origin, political affiliation, race, religion, sexual orientation, genetic information, veteran status, or any other basis protected by law. An equal opportunity/affirmative action employer. Issued in furtherance of Cooperative Extension work, Virginia Polytechnic Institute and State University, Virginia State University, and the U.S. Department of Agriculture cooperating. Edwin J. Jones, Director, Virginia Cooperative Extension, Virginia Tech, Blacksburg; M. Ray McKinnis, Interim Administrator, 1890 Extension Program, Virginia State University, Petersburg. Extension is a joint program of Virginia Tech, Virginia State University, the U.S. Department of Agriculture, and state and local governments.



Project Demonstrations, Short Courses & Field Days



The Farm Manure-to-Energy Initiative

Increasing Manure Management Options – Generating On-farm Thermal Energy – Improving Water Quality

Kristen Hughes Evans, Project Director, Dr. Mark Rotter, John Ignoffo

Description

The Farm Manure-to-Energy Initiative is demonstrating and evaluating the performance of on-farm thermal technologies used to convert excess poultry litter to heat animal housing in high-density animal production regions of the Chesapeake Bay watershed. The goal is to expand management and revenue-generating opportunities for poultry litter in concentrated animal production regions of the watershed where more manure phosphorus is produced than local crops need as fertilizer.

On-farm Thermal Conversion Technology Demonstrations

Thermal technologies capable of producing energy from poultry litter feedstock have only recently been developed for use at the farm-scale. The pictures below highlight the primary thermal conversion technologies explored by this project.

Designed & Installed by LEI Products

LEI Bio-Burner

Blue Flame Boiler

Design & Installation by Total Energy

Designed and Installed by Triunvir Energy, LLC

Ecoremedy Gasifier

Design & Installation by Wayne Combustion

Global Refuel

Assessing Project Performance

This initiative is evaluating the technical feasibility and environmental and economic performance of these technologies to help farmers determine whether this approach makes sense for their farm. Partners are also working to expand markets for nutrient-dense biochar and ash, as well as to increase technical assistance, information, and financing options available to farmers. Partners are monitoring environmental performance by tracking the form and fate of poultry litter nitrogen and phosphorus, as well as collecting comprehensive air emissions data including criteria and hazardous air pollutants. Air emissions data will be collected by a certified, third party air emissions testing company using EPA-approved testing methods.

Developing New Markets

While generating thermal energy, these systems also convert excess poultry litter into nutrient-dense ash or biochar. This material could potentially be more cost-effectively transported long distances or used to replace imported commercial phosphorus in local nurseries and fresh-market vegetable operations. The poultry litter ash was evaluated at the Virginia Tech Eastern Shore Agricultural Research and Extension Center and found to contain in the range of 14-18% phosphorus and 13-24% potash fertilizer. Biochar has approximately two to three times the nutrient density of original poultry litter and provides long-term carbon storage. Laboratory studies indicate plant availability of the nutrients is in the range of 80-100%.

Sharing Project Experiences

Results from performance evaluation will be shared on a clearinghouse website hosted by eXtension and developed by the Farm Manure-to-Energy Initiative to share information about thermal manure-to-energy projects including a recent webinar now posted as a YouTube video.

Please Contact Us For More Information

Project Poster Developed by:

- Kristen Hughes Evans, President, Sustainable Chesapeake, Richmond, VA
- Priscilla Bainschke, Project Engineer, Farm Pilot Project Coordination, Inc., Greensboro, NC
- Dr. Mark Rotter, Ext. Specialist/Assoc. Professor, Crop and Soil Environmental Science, Eastern Shore Agricultural Research and Extension Center, Virginia Tech, Patuxent, VA
- John Ignoffo, Area Specialist, Agricultural Byproduct Utilization, Virginia Cooperative Extension, Biological Systems Engineering, Virginia Tech, Harrisonburg, VA

Virginia Tech • Virginia State University

Virginia Agricultural Experiment Station

Exploring Agrophotovoltaics in Guatemala to Foster Positive Change

Mario Buch¹ and John Ignosh²

¹Section Chief, Agricultural and Forestry Research, Escuela Nacional Central de Agricultura, Villa Nueva, Guatemala
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CONTEXT

- In recent years, there has often been a focus on accompanying children (MAG) coming to the United States from Central America. Many NGOs have organized these Guatemala with many around 15 years of age (SAGM, 2015).
- There are many things to consider about migration among teenagers, including:
 - Adverse events, food insecurity, climate change, lack of economic opportunity, among others.
 - Not providing economic opportunities in agricultural value chain work, for example:
 - Involving parents of non-migrating agricultural production to avoid generating additional employment opportunities in the sector.
 - Increasing production by high-value products could increase farm income by 50% (World Bank, 2015).
 - However, more complex production systems require continuing technical assistance capacity. Agricultural techniques at farming installation offer a strategic avenue to help agriculture in these opportunities and affect these broader changes.

AGROPHOTOVOLTAICS (APV)

The feasibility studies for solar energy systems in Guatemala are as follows (IE, 2020):

- Agri-food production allows self-generated essential photovoltaic powerplants that are especially developed for this purpose.
- Generate efficient use of land to mitigate conflict between food and energy security.

Figure 7. From the IE Department of Energy (SAGM) Project presents a conceptual graphic of an example APV system.

Fig. 7. Graphic for a Conceptual APV System from IED Department of Energy (SAGM) Project (IEE, 2020).

RESPONSE & POTENTIAL IMPACT

- The school's multi-year team by doing agrophotovoltaics in true fashion, students have been involved. For example ENCA students have managed solar-powered irrigation systems using a Future Pump for irrigation applications during the dry season (Figure 7). Similarly, Virginia Tech senior design teams have visited ENCA to develop conceptual designs for solar energy applications (Figure 8):
- These types of student-centered experiential learning opportunities are critical to enhance utilization of graduates.
- While these projects opportunities are in the early exploratory phase, systems concepts show promising opportunities for applications on school campuses and beyond.
- If successful, future agrophotovoltaic APV project demonstrations will enable hands-on learning opportunities to foster student development to gain broader development opportunities in the sector and foster positive change for the youth in the region.

APV IN GUATEMALA

Guatemala is the second most densely populated country in Central America with approximately 152 population (Figure 3) World Bank, 2020).

- To enhance agricultural productivity with a limited land area, the country has adopted many agricultural systems to develop multi-crop systems, to enhance growth of cultivation systems such as: cacao (Theobroma cacao), coffee (Coffea arabica), cardamom (Elettaria cardamomum), among others.
- These forms of production systems can yield multiple benefits, and enhance sustainable land use intensity and system resilience.
- Consequently, APV systems may serve as similar opportunities for multi-benefit production/generation systems, for certain locations and agricultural production systems. Our collaboration seeks to explore some of these APV opportunities through student-centered experiential learning and inter-institutional collaborations.

NATIONAL AGRICULTURAL AND FORESTRY EDUCATION SYSTEM

The National Agricultural and Forestry Education System (NAFES) serves as the lead and governing body of the Guatemala National Agricultural and Forestry Education System, a network of 39 schools across the country (Figure 9), a network that educates nearly 180 agricultural and forestry students each year across the entire country, graduating approximately 1,500 students annually.

- From 2018 – 2020, Guatemala's National Council of Agricultural (NCA), QEPH, IAHSA University and Virginia Tech have collaborated on a program sponsored by the Millennium Challenge Corporation (MCC) (MCC-2018-10) to enhance educational curricula, provide teacher engagement, and foster the training. The program work also aimed to engage ongoing collaborations related to APV, among other areas.
- ENCA and Virginia Tech are collaborating to explore opportunities to integrate renewable renewable energy technologies with agri-food production systems to foster experiential learning opportunities for students across the network of 39 agricultural and forestry schools throughout the country who offer vocational education to 16-18 year olds. Of particular interest to collaborations, are applications utilizing solar photovoltaics integrated with solar water irrigation applications via integrated "agrophotovoltaic" (APV) systems.
- Adoption of technical and pedagogical best practices will help the nation reach its potential and foster positive agri-food growth across the agri-food sector, including:
 - Identifying, offering grants economic, opportunities, and future, for the youth included.

EXPLORING POTENTIAL APV APPLICATIONS

A variety of APV applications seem to be explored, for example:

- Figure 4 highlights a scenario for APV in the Dry Corridor region of Guatemala, where pronounced droughts have resulted in many socio-economic challenges. This scenario explores systems in an area receiving 17% less rainfall with a pronounced arid/semi-arid (dry period during rainy season) between two agricultural technical systems (2.2 ha) used along a road corridor providing 2 electrical transmission lines (200 kV & 150 kV). An APV application of 10 MW would generate ~ 10 MWh/y with an energy value of approximately \$100 (USD), and the ~ 10 m² surface of the PV array would potentially serve to harvest approximately 10% pathway of rainwater for crop irrigation during average intervals, with potential sites for multiple arrays in region.
- Figure 5. While much of Guatemala has made progress on solar electrification, the graphic shows portions of the country (e.g., near agricultural farming schools) where electrification rates are ~ 12%. APV systems could serve as a means to generate multiple benefits for small holder farmers lacking grid-level electrical energy.
- Figure 6. Many production systems in the region are cultivated with some portion of shade (e.g., agroforestry, controlled environmental agriculture, shade houses, etc.). This graphic shows examples of the many production systems utilizing limited polyethylene shade cloth. APV systems may be a means to generate co-benefits, while providing shade.

REFERENCES

IEE, 2020. PV Sheds. Student Design Team (John, Brian, Caitlyn, and ...). International Solar Inc. Dry Corridor Farm Electrification, 24 Guatemala, Guatemala.

IEE, 2020. Solar Shed. Student Design Team (John, Brian, Caitlyn, and ...). International Solar Inc. Dry Corridor Farm Electrification, 24 Guatemala, Guatemala.

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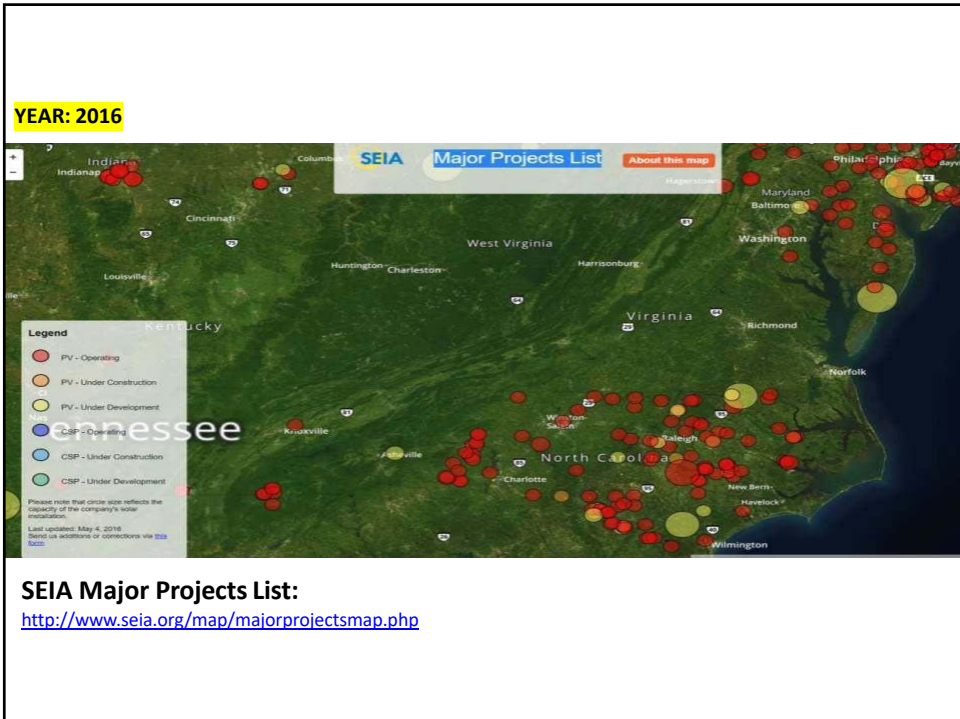
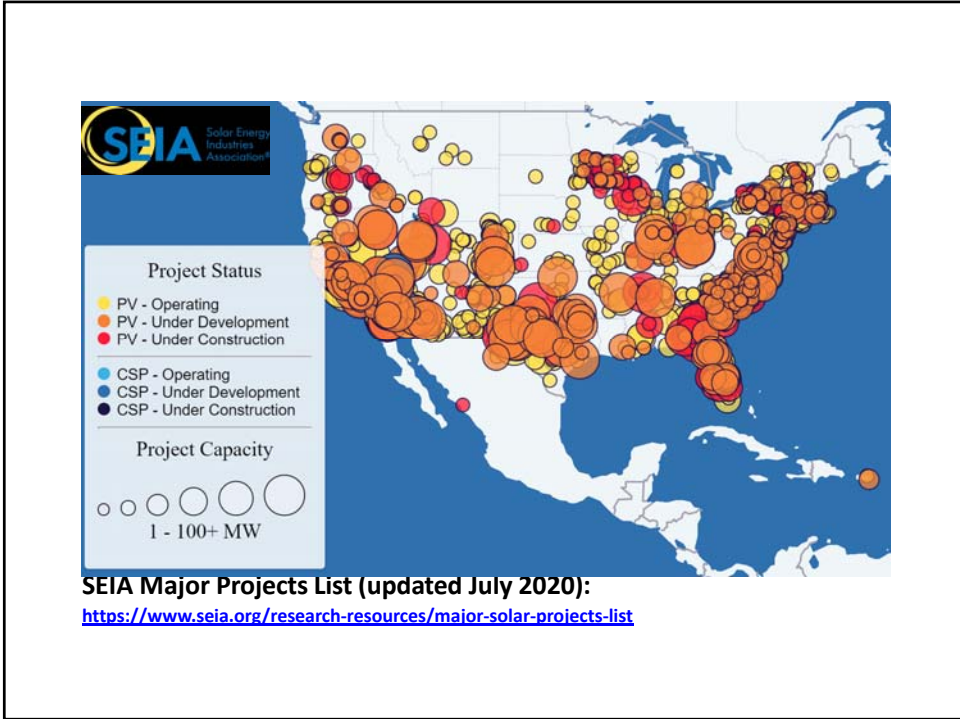
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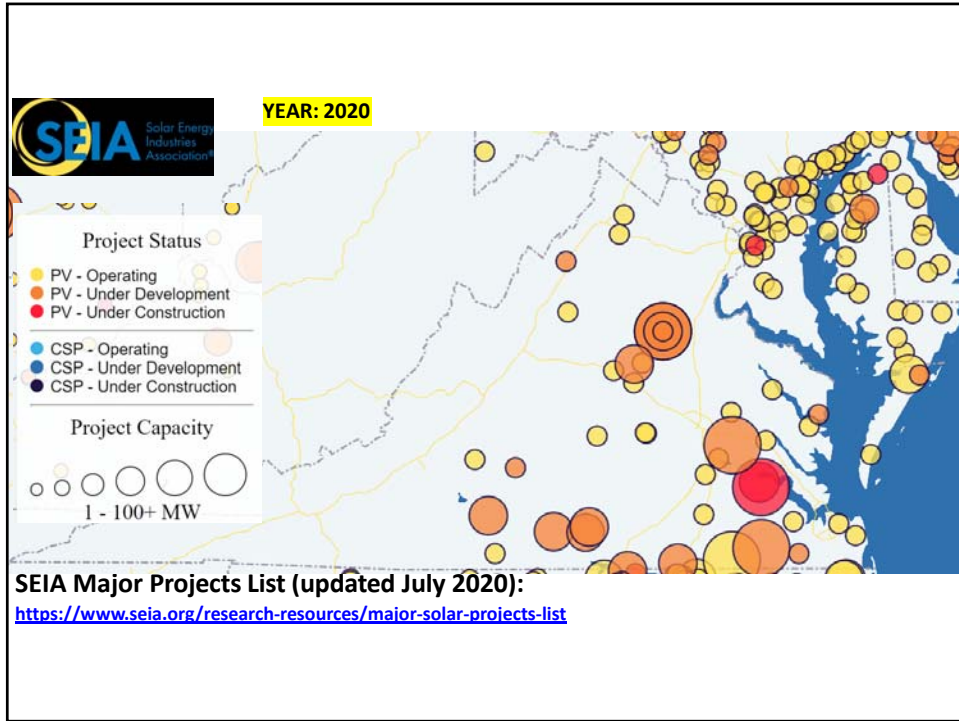
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IEE, 2020. Solar Shed. Student Design Team (John, Brian, Caitlyn, and ...). International Solar Inc. Dry Corridor Farm Electrification, 24 Guatemala, Guatemala.

Sharing Experiences & Considerations on Utility-scale Solar Projects from Virginia Localities

Off-grid Applications	Residential	Commercial	Utility-Scale ("Solar Farm")
			
~ < 1kW	~ 1 - 10 kW	~ 10 kW – ~ 2 MW	~ > 2MW
Photo Source: 400W Solar-powered Water Pumping for Livestock, VT Field Research Project	Photo Source: Virginia Cooperative Extension: Fundamentals of Solar Photovoltaics Video: https://youtu.be/73w7Pcr9c70	Photo Source: 100 kW Grid Interactive Solar PV Perry Street Parking Garage, Virginia Tech Blacksburg, VA Video: https://www.youtube.com/watch?v=BG6bml_QWZ0	Photo Source: SOLAR PV SYSTEMS by Tommy Cleveland, NC Clean Energy Technology Center NC State University Video: https://youtu.be/0K57D93m3o





Utility-Scale Solar PV in Virginia

Artifacts from Informational Webinars

INFORMATIONAL WEBINAR
Virginia Resources for Utility-Scale "Solar Farms"
 Thursday, May 28th 12:00 PM - 1:00 PM

Join us for a webinar that will explore the various utility-scale solar projects in Virginia. This webinar will provide an overview of the solar market in Virginia, including the current market conditions and the potential for growth. We will also discuss the various resources available to support the development of utility-scale solar projects in Virginia. Please join us for this informative webinar and learn more about the opportunities available in the solar market.

Dr. Don Brown, Executive Director, Office of Energy Policy, Virginia Tech
Dr. Richard Smith, Director of Energy Policy, Virginia Tech

DMTE

REGISTER FOR THE WEBINAR HERE

Virginia Cooperative Extension
 Virginia Tech • Virginia State University

INFORMATIONAL WEBINAR
Exploring Agrivoltaic Project Experiences
 Informational Webinar 9-10 AM JUNE 18, 2020

Agriculture and solar are complementary. Agrivoltaics are designed to be a generation of solar systems that are also suitable for agriculture. They combine the benefits of solar and agriculture, by providing shade for crops, reducing irrigation needs, and increasing crop yields. This webinar will explore the various agrivoltaic projects in Virginia, including the current market conditions and the potential for growth. We will also discuss the various resources available to support the development of agrivoltaic projects in Virginia. Please join us for this informative webinar and learn more about the opportunities available in the agrivoltaic market.

Dr. Richard Smith, Director of Energy Policy, Virginia Tech
Dr. Don Brown, Executive Director, Office of Energy Policy, Virginia Tech

Fraunhofer

SECURE FUTURES

REGISTER FOR THE WEBINAR AT THIS LINK

Virginia Cooperative Extension
 Virginia Tech • Virginia State University

INFORMATIONAL WEBINAR
Sharing Experiences & Considerations for Utility-Scale Solar Projects in Virginia
 Wednesday, October 14th 12:00 PM - 1:00 PM

Join us for a webinar that will explore the various utility-scale solar projects in Virginia. This webinar will provide an overview of the solar market in Virginia, including the current market conditions and the potential for growth. We will also discuss the various resources available to support the development of utility-scale solar projects in Virginia. Please join us for this informative webinar and learn more about the opportunities available in the solar market.

Dr. Don Brown, Executive Director, Office of Energy Policy, Virginia Tech
Dr. Richard Smith, Director of Energy Policy, Virginia Tech

DEQ

Geosyntec consultants

Dr. Don Brown, Executive Director, Office of Energy Policy, Virginia Tech
Dr. Richard Smith, Director of Energy Policy, Virginia Tech

REGISTER FOR THE WEBINAR HERE

Virginia Cooperative Extension
 Virginia Tech • Virginia State University

INFORMATIONAL WEBINAR
Sharing Experiences & Considerations on Utility-Scale Solar Projects from Virginia Localities
 Monday, December 14th 12:00 PM - 1:00 PM

Join us for a webinar that will explore the various utility-scale solar projects in Virginia. This webinar will provide an overview of the solar market in Virginia, including the current market conditions and the potential for growth. We will also discuss the various resources available to support the development of utility-scale solar projects in Virginia. Please join us for this informative webinar and learn more about the opportunities available in the solar market.

Dr. Don Brown, Executive Director, Office of Energy Policy, Virginia Tech
Dr. Richard Smith, Director of Energy Policy, Virginia Tech

Highlighting a Range of Virginia Project Experiences & Issues
Mr. Richard Smith, Director of Energy Policy, Virginia Tech

Land Use Considerations in Virginia
Mr. James Coffey & Mr. Dennis Nelson, Virginia Tech

New Policy Developments in Virginia
Mr. Joe Lewis, Virginia Tech

Land Use Considerations & NEPA in Solar Agreements
Mr. Tom Swartzendruber, Virginia Tech


The Rollback Program & Eminent Domain
Mr. William Marshall, Virginia Tech

REGISTER FOR THE WEBINAR HERE


Virginia Cooperative Extension
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Sources: <https://sites.google.com/vt.edu/vceinservice121919solarfarms/home>


INFORMATIONAL WEBINAR
Grid Interconnection, Siting & Utility-scale Solar Projects in Virginia
 Thursday, April 22nd 10AM – 11:15AM




"Solar Farms"- Also known as "utility-scale solar photovoltaic" projects, are increasing across Virginia. Many projects have been developed and many more proposed, each presenting its own set of unique challenges and opportunities. This webinar will highlight information regarding electrical grid interconnection considerations, processes, and policies in Virginia in the context of a new project by Old Dominion Electric Cooperative in Shenandoah Valley Electric Cooperative's service territory. Please join us to hear these presentations, learn more about the interconnect aspects of utility-scale solar in Virginia, and ask your questions.



Mr. Bill Pezalla, Director of Transmission Services, Old Dominion Electric Cooperative (ODEC)
 Mr. Pezalla is the Director of Transmission Services and oversees the planning, construction and operations of ODEC's transmission system, the 250+ transmission delivery points to 11-member owner Cooperatives and provides technical guidance on new generator interconnections and processes.






Mr. Myles Burnsed, Vice President, Strategic Developments, EDF Renewables
 Mr. Burnsed leads Distributed Solutions market strategy and new market development efforts for EDF Renewables. During this presentation he will share interconnect considerations from the project developer's perspective.

PLEASE REGISTER FOR THIS WEBINAR HERE:
<https://virginiatech.zoom.us/j/6281120>

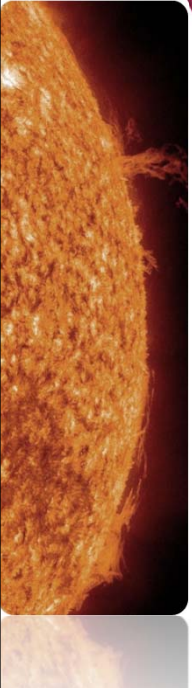
If you are a person with a disability and desire any assistive devices, services or other accommodations to participate in this activity, please contact John Ignosh, Dept. of Biological Systems Engineering, VCE Northern District Office at 540-432-6029/TDD* during business hours of 8 a.m. and 5 p.m. to discuss accommodations 5 days prior to the event.
 *TDD number is (800) 828-1120.




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Sources:
<https://sites.google.com/vt.edu/vceinservice121919solarfarms/home>





The Virginia Tech Solar "Panel"

A New Pilot Project from Virginia Tech's College of Agriculture and Life Sciences & Virginia Cooperative Extension




Context:
 A pilot project to drive a collaborative process for industry-engaged, and stakeholder-relevant, prioritized research/extension work focused on responding to utility-scale solar (USS) issues in Virginia

Method:

- Transdisciplinary VT-led "panel", with input via collaboration of internal and external stakeholders with experiences, insights, questions & concerns regarding USS in VA. Over 15 VT and other faculty involved.
- Iterative process to identify, refine & prioritize research/extension needs via modified DELPHI process, to better target limited resources and best respond with timely information
- Framework for parsing issues best addressed by adapting information from the existing literature from those issues that may warrant further investigation via original research to address knowledge gaps

Initial Pilot Period:
 March 2021 – June 2022 (with potential for additional phases)



PRIORITIES

- 1.
- 2.
- 3.

Internal Collaborators

From:

COLLEGE OF ENGINEERING
 COLLEGE OF AGRICULTURE AND LIFE SCIENCES
 BIOLOGICAL SYSTEMS ENGINEERING

COLLEGE OF AGRICULTURE AND LIFE SCIENCES
 SCHOOL OF PLANT AND ENVIRONMENTAL SCIENCES
 VIRGINIA AGRICULTURAL EXPERIMENT STATION
 VIRGINIA SEAFOOD AGRICULTURAL RESEARCH AND EXTENSION CENTER

COLLEGE OF AGRICULTURE AND LIFE SCIENCES
 AGRICULTURAL AND APPLIED ECONOMICS
 VIRGINIA AGRICULTURAL EXPERIMENT STATION
 SHENANDOAH VALLEY AGRICULTURAL RESEARCH AND EXTENSION CENTER

COLLEGE OF NATURAL RESOURCES AND ENVIRONMENT
 FOREST RESOURCES AND ENVIRONMENTAL CONSERVATION
 COLLEGE OF NATURAL RESOURCES AND ENVIRONMENT
 FISH AND WILDLIFE CONSERVATION

Program Evaluation

- It is important to consider program evaluation during the program-planning process (and timeline)
- Needs assessment (an evaluation itself of stakeholder needs) results determine program goals
- Continual stakeholder feedback from program activities indicates how the program can be improved
- Evaluation provides documentation of program results for reporting impacts

Source: Seevers et al. 2007 "Education through Cooperative Extension" 2nd Edition, Chapter 5

Solar Energy Workshop Evaluation Instrument Excerpt

Content	Excellent	Very Good	Good	Fair	Poor
1. Content covered during the presentations	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2. Relevance of content to your requirements	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3. Usefulness of activities conducted during the workshop	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4. Presenters' knowledge of subject	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
5. Presenters' style of teaching and communication	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
6. Presenters' response to doubts and queries	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
7. Usefulness of handouts at workshop	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
8. Workshop registration process	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
9. Overall experience at workshop	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
10. How worthwhile was the workshop in terms of time and expense?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

• What did you gain most from this workshop?

• Would you do anything different to make this workshop more effective?

• Do you have any additional recommendations to improve future workshops?

• Please list any energy-related topics that you'd be interested in learning more about.

• Would you be interested in earning Continuing Education Units (CEUs), Professional Development Hours (PDHs), etc. in future sessions? Or, is a Certificate of Participation sufficient? Or, does it make no difference to you?

• How do you prefer to pay event registration fees prior to the day of the event?
 CHECK VIA MAIL ONLINE WITH CREDIT CARD OTHER: _____

• Would you attend this type of workshop again? Or recommend it to friends and acquaintances?
 YES NO

Directions: Please rate your learning in this session. Place an **X** in the box to indicate your response.

Overall, how much did you learn from this session?
 Nothing ← Some → A lot

Please rate each of the following: Low ← Moderate → High

My Knowledge of Project Analysis

Before Participation

Now, After Participation

My Awareness of Resources for Additional Information to Aid in Solar PV Project Exploration

Before Participation

Now, After Participation

My Knowledge of NREL's System Advisor Model (SAM)

Before Participation

Now, After Participation

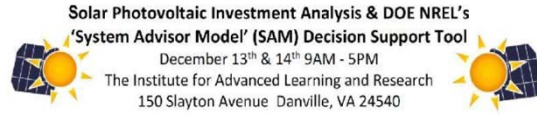
Do you anticipate sharing and/or applying any of the information obtained through this workshop with others?

YES NO MAYBE

Please list one action you intend to take as a result of this workshop:

Please share any additional comments here:

Solar Energy Decision Support Tool Short-course Workshop Results

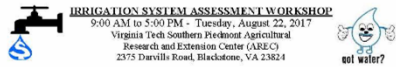


Twelve people registered or presented at this two-day workshop, 50% of which returned a workshop evaluation form. Figure 1 describes selected aggregate workshop evaluation results on a 5-point scale (1 star = poor/low, 5 stars = excellent/a lot). 100% of respondents indicated that they would attend this type of workshop again in the future or recommend this workshop to a friend. Participants indicated that some of the most beneficial parts of the workshop related to: learning how to use SAM, learning directly from subject matter experts, obtaining resources to later share with farmers, gaining more hands-on experience with the SAM decision support tool, learning about the current state of the solar industry, learning about SAM applications in the agriculture sector, among other areas. 100% of respondents anticipated sharing, or applying, the information learned through this workshop with others. 100% of respondents identified specific actions they plan to take as a direct result of this workshop, including: contacting farmers to share information, meeting with farmers to review solar projects using SAM, using data and SAM to evaluate projects, better use of SAM to teach about solar analysis, working to build partnerships between the agricultural extension community and NREL, among others.

Figure 1: Selected Aggregate Workshop Evaluation Results

ASPECT OF WORKSHOP	RATING	1	2	3	4	5
5 STAR CHART						
How worthwhile was the workshop in terms of participants' time and expense?	5.00	★	★	★	★	★
Overall, how much did participants learn from this session?	5.00	★	★	★	★	★
Participants' Knowledge of Project Analysis						
BEFORE Workshop	1.75	★	★	★	★	★
AFTER Workshop	4.50	★	★	★	★	★
Participants' Awareness of Resources for Solar PV Project Exploration						
BEFORE Workshop	2.67	★	★	★	★	★
AFTER Workshop	5.00	★	★	★	★	★
Participants' Knowledge of NREL's System Advisor Model (SAM)						
BEFORE Workshop	2.00	★	★	★	★	★
AFTER Workshop	4.50	★	★	★	★	★

Irrigation Workshop Evaluation Instrument Excerpt



Please join us for a workshop exploring irrigation system assessments. This workshop is offered as part of the Sustainable Agriculture Program and is a program funded by a 2014 grant from the Virginia Tobacco Settlement and Revitalization Commission and supported by Virginia Cooperative Extension's Community Viability and Biological Systems Engineering Department.

This event will be held at the Virginia Tech Southern Piedmont Agricultural Research and Extension Center (ARC-3), directions are available at: arc3.vt.edu and the address is: Virginia Tech Southern Piedmont Agricultural Research and Extension Center (ARC-3), 2375 Danville Road, Blacksburg, VA 24064.

Workshop Content & Format: The workshop will feature a mix of presentations and in-class irrigation assessment activities - please come prepared to get a bit muddy! We'll begin with background information about irrigation system assessment practices, system assessment techniques, overview of USDA financial and technical assistance programs related to improving on-farm, and highlight decision support tools. Then, we'll go in "hands-on" mode for a brief tour of the Virginia Tech Southern Piedmont Agricultural Research and Extension Center while in route to our hands-on irrigation system assessment activities. After getting both knowledge and muddy in the field, we'll head back to the classroom to review the data collected, analyze and interpret it in assessment decisions.

Registration Information: Registration is required and space is limited. **Participants may register by calling (804) 292-5391 AND sending a check to \$12 via our on-line "Check for an Event" link on the Virginia Tech Southern Piedmont Agricultural Research and Extension Center (ARC-3) 2375 Danville Road, Blacksburg, VA 24064, please note in the check memo "Irrigation Workshop". The check must be received by August 18, 2017.** A box lunch will be provided. Please indicate any dietary restrictions during registration.

- General Workshop Agenda:**
- SAM - Morning Presentations (9AM - Lunch (12:00PM))
 - SPM - Field Assessment Workshop - Assessment Analysis & Afternoon Presentations (2PM - End of Workshop)
- Workshop Presenters:**
- Dr. Don Johnson, Washington State University
 - Dr. Terry Peters, Washington State University
 - Dr. Martin Parlant, Acting National Water Management Engineer, USDA-NRCS
 - Mrs. Laurette Tucker, VAASD Rural Development
 - Mrs. David Hancock, District Conservationist, VA-NRCS
 - Mrs. Sean Kimmel, Area Engineer, VA-NRCS
 - Dr. David Reed, Extension Agronomist, Tobacco, Southern Piedmont Agricultural Research and Extension Center, Virginia Tech
 - Dr. Julie Blankenship, Extension Specialist, Biological Systems Engineering, Virginia Tech & Extension
 - Mrs. Marie Parham, Virginia Cooperative Extension
 - Mr. John Lopez, Area Specialist, Biological Systems Engineering, Virginia Cooperative Extension

Notes: If you are a person with a disability and desire any assistive devices, services or other accommodations to participate in this activity, please contact: room 2003 at 2322 Blue Stone Hill Drive Harrisonburg, VA 22801 at (540) 852-0800; TDD: room 2003-1100 during business hours of 9 a.m. and 5 p.m. to discuss accommodations in advance of the event. Virginia Cooperative Extension programs and employees are open to all, regardless of age, color, disability, gender, genetic identity, gender expression, marital origin, national or ethnic origin, race, religion, sexual orientation, genetic information, veteran status, or any other characteristics protected by law. An equal opportunity affirmative action employer, listed in furtherance of Cooperative Extension work, Virginia Polytechnic Institute and State University, Virginia State University, and the U.S. Department of Agriculture cooperating. Glenn L. Jones, Director, Virginia Cooperative Extension, Virginia Tech, Blacksburg, VA. Ray Whitcomb, Administrative Director, 1890 Extension Program, Virginia State University, Petersburg. Tennessee is a state program of Virginia Tech, Virginia State University, the U.S. Department of Agriculture, and state and local governments.

Directions: Please rate your learning in this session. Place an X in the box to indicate your response.

Nothing ← ← ← Some → → → A lot

Overall, how much did you learn from this session?

<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
--------------------------	--------------------------	--------------------------	--------------------------	--------------------------

Please rate each of the following: Low ← ← ← Moderate → → → High

My Knowledge of Irrigation System Assessments

Before Participation	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Now, After Participation	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

My Knowledge of USDA Programs Related to Energy & Irrigation

Before Participation	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Now, After Participation	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

My Awareness of Research-based Resources & Informational Contacts for Energy & Irrigation Info

Before Participation	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Now, After Participation	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Do you anticipate sharing and/or applying any of the information obtained through this workshop with others?

YES NO MAYBE

Please list one action you intend to take as a result of this workshop:

Please share any additional comments here:

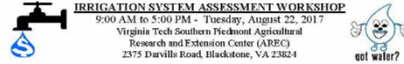


Irrigation Workshop Results

Twenty-nine people participated in the workshop, 65% workshop evaluation forms were returned. **Figure 1** describes selected aggregate workshop evaluation results on a 5-point scale (1 star = poor/low, 5 stars = excellent/a lot). 100% of respondents indicated that they would attend this type of workshop again in the future or recommend this workshop to a friend. Many participants indicated that some of the most beneficial content related to: irrigation system evaluation procedures, variety of technical and financial assistance programs related to farm energy and water management, awareness of variability in water distributions, drip irrigation system components and technology, determining system flow rate, and specific steps to improve water management. 76% of respondents anticipated sharing, or applying, the information learned through this workshop with others. **43% of respondents had identified specific actions they plan to take as a direct result of this workshop, including: assessing drip irrigation system, utilizing irrigation scheduling, using uniform irrigation components, increasing amount of overlap, flushing irrigation lines, more robust system monitoring, changing timing of irrigation applications, developing a water management plan, among others.**

Figure 1: Selected Aggregate Workshop Evaluation Results

ASPECT OF WORKSHOP	RATING	1	2	3	4	5
5 STAR CHART						
How worthwhile was the workshop in terms of participants' time and expense?	4.00	★	★	★	★	★
Overall, how much did participants learn from this session?	4.00	★	★	★	★	★
Participants' Knowledge of Irrigation System Assessments						
BEFORE Workshop	2.50	★	★	★	★	★
AFTER Workshop	4.00	★	★	★	★	★
Participants' Knowledge of USDA Programs Related to Energy & Irrigation						
BEFORE Workshop	2.00	★	★	★	★	★
AFTER Workshop	4.00	★	★	★	★	★
Participants' Awareness of Research-based Resources & Informational Contacts for Energy & Irrigation Info						
BEFORE Workshop	3.00	★	★	★	★	★
AFTER Workshop	4.00	★	★	★	★	★



Thank You!

Commission of University Support Meeting

“Virginia Cooperative Extension Renewable Energy Programs”

*Energy Management Related Extension Programming
A Brief Intro Presentation*

2PM Thursday April 15, 2021

John Ignosh
Extension Specialist, BSE/VCE-VT
Harrisonburg, VA
540-232-6009
jignosh@vt.edu

