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"

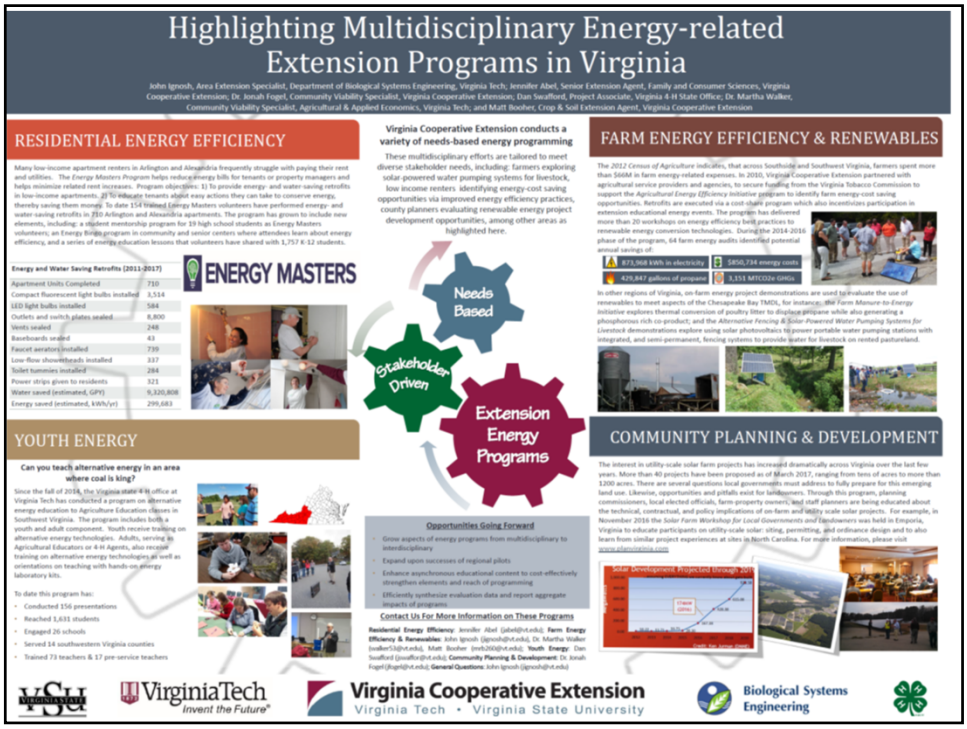
Energy Management Related Extension Programming
A Brief Intro Presentation

2PM Thursday April 15, 2021

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

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

Virginia Cooperative Extension
Virginia Tech • Virginia State University



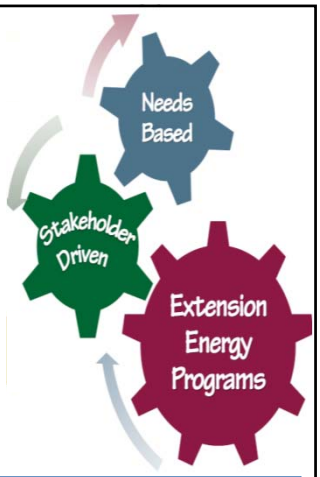
Areas I generally work in….

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

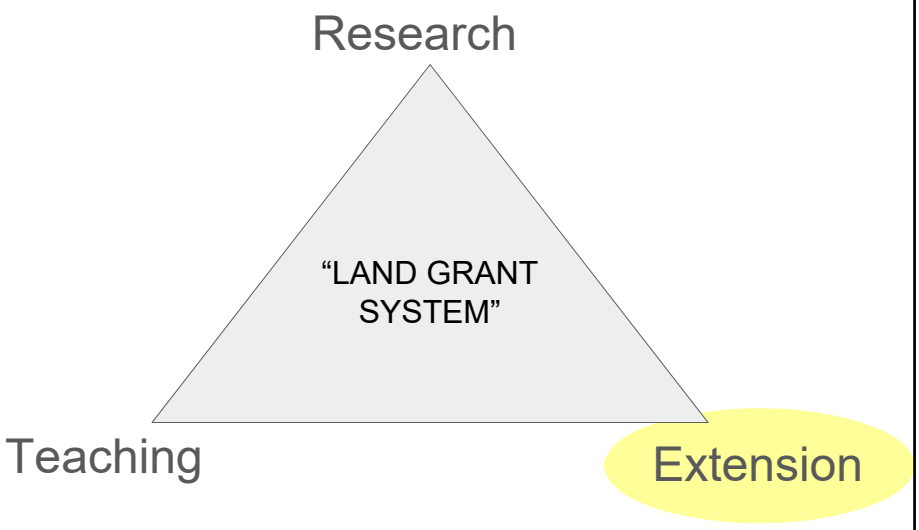
Focus Areas:

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

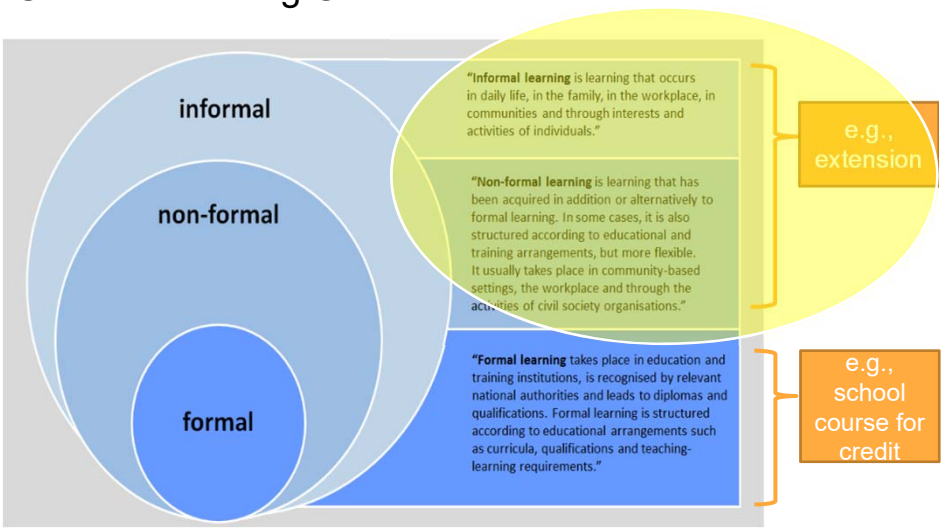


Promote the efficient utilization of agricultural byproducts. This role includes:

- 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



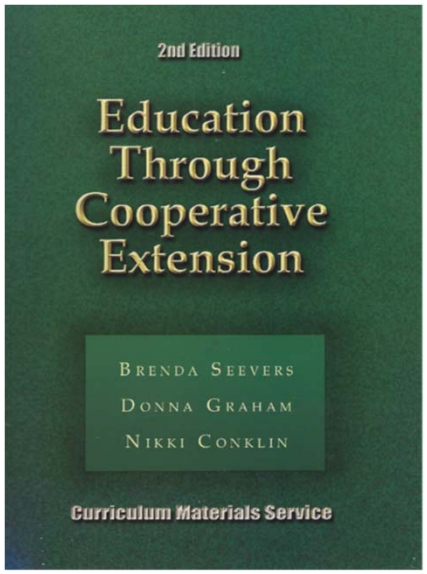
General Learning Classifications



Fuente: UNESCO
http://reopen.eu/learn/mod/book/tool/print/index.php?id=9

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

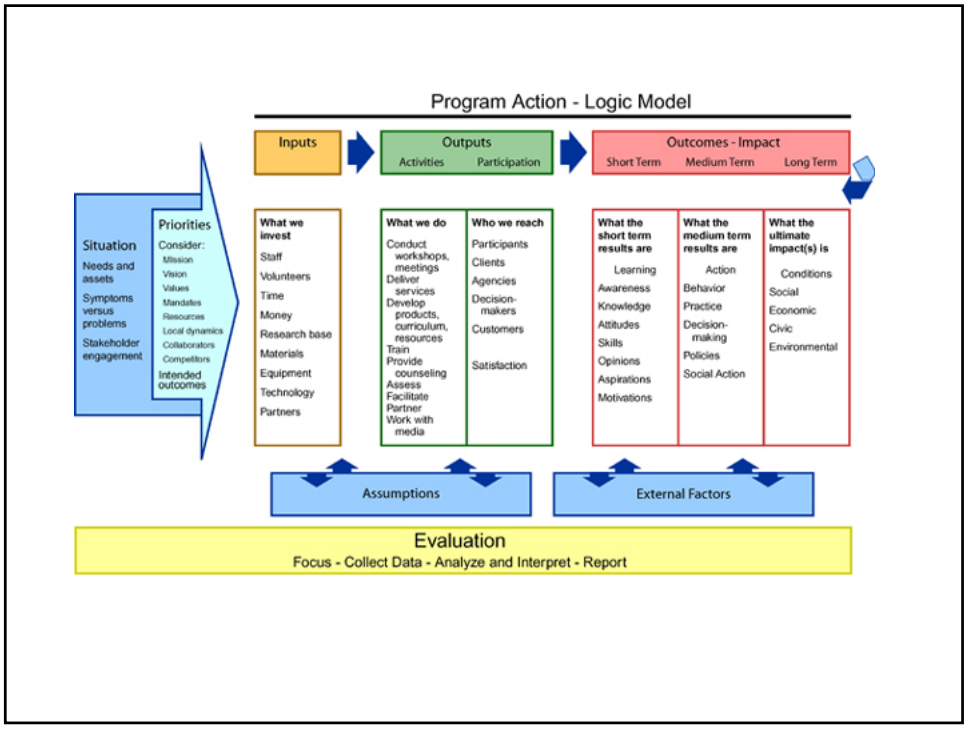
Setting Priorities – *Constraints?*

- 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")

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

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.)



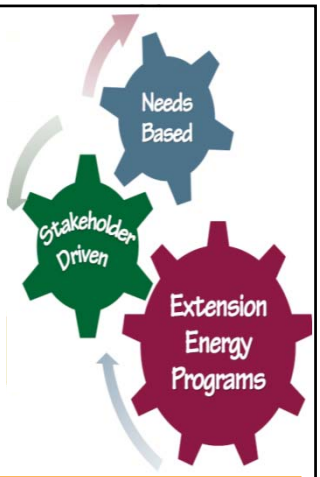
Areas I generally work in….

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:

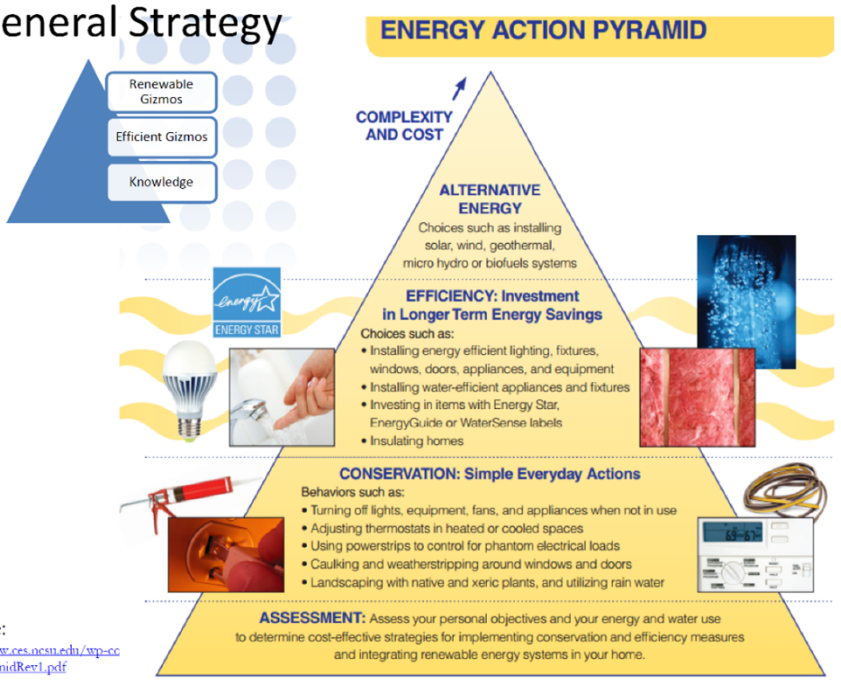
- Collaborating on regional efforts to assess opportunities to integrate nutrient management technologies with renewable energy generation
- Providing unbiased technical information on bioenergy conversion technologies including anaerobic digestion, biodiesel and thermal conversion processes
- Assisting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

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

General Strategy



Source:
http://www.ces.ncsu.edu/wp-cc
Con_PyramidRev1.pdf

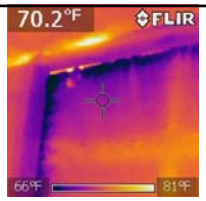
Issue: Increasing LPG prices impacting poultry producers, greenhouse growers & tobacco farmers

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

https://www.growersolution.com/page/GS/CTGY/quonsetkit

https://www.shelterlogic.com/shop/high-tunnel-greenhouse-30-x-96-x-12-ft-gothic-shape-full-kit

Case Study 1

Total WH/Day=
101,196

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

Case Study 2

Total WH/Day=
171,992

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

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

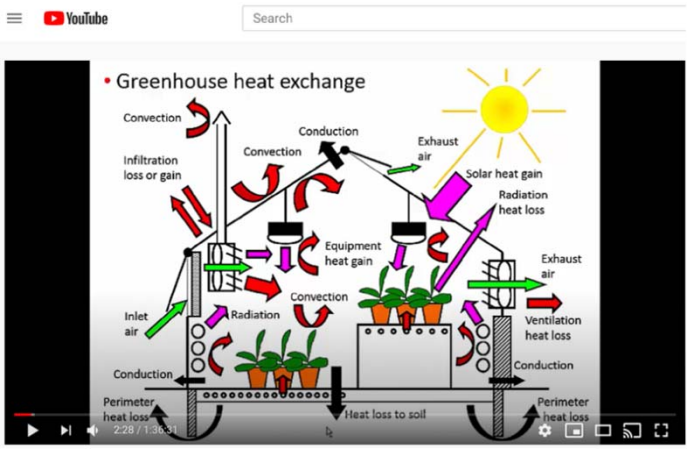
Source: 2010. Dunlop, J. Photovoltaic Systems, Second Edtion. NJATC, American Technical Publishers, Inc.

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)

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

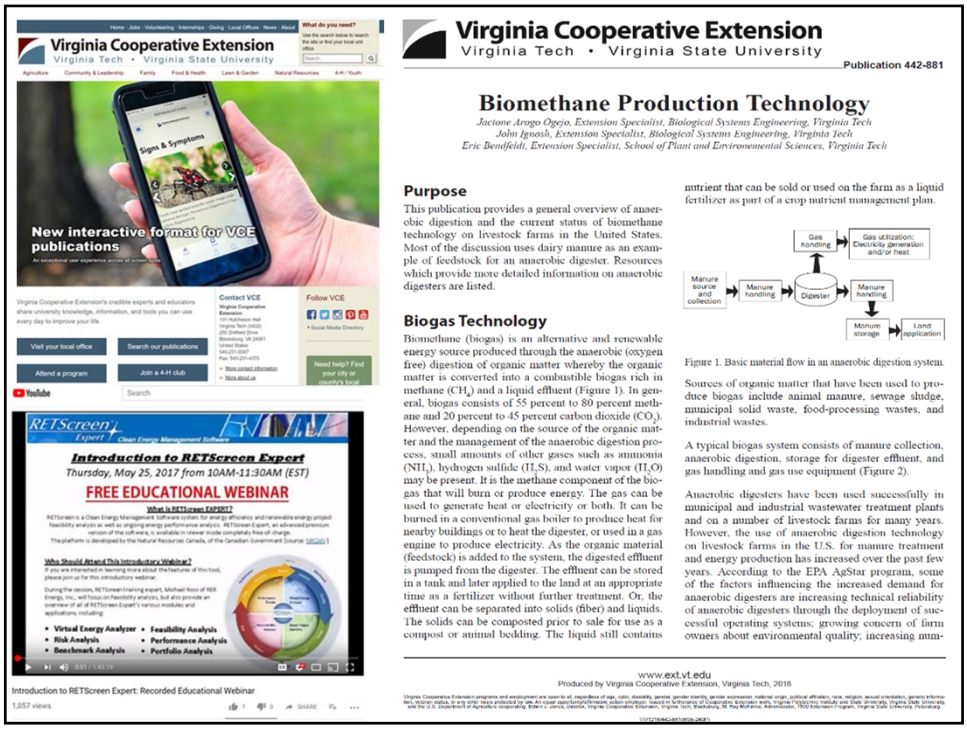


Energy Audits USDA - NRCS

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 (ccf)	Propane Savings (gal)	Other[1]	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 Curtain			98		9	$450	$167	2.7	10
Exposed Foundation Wall Insulation			383		35	$5,621	$651	8.6	20
Curtain to Solid Insulated Sidewalls			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=stelprdb1046252
https://www.nrcs.usda.gov/wps/PA_NRCSConsumption/download?cid=stelprdb1264606&ext=pdf



Additional Resources

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?]

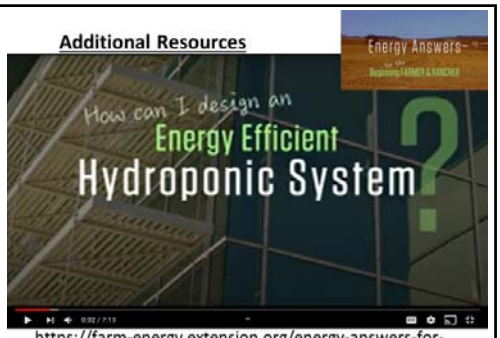
[How to save money by understanding your electric bill?]

[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?]

Additional Resources



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

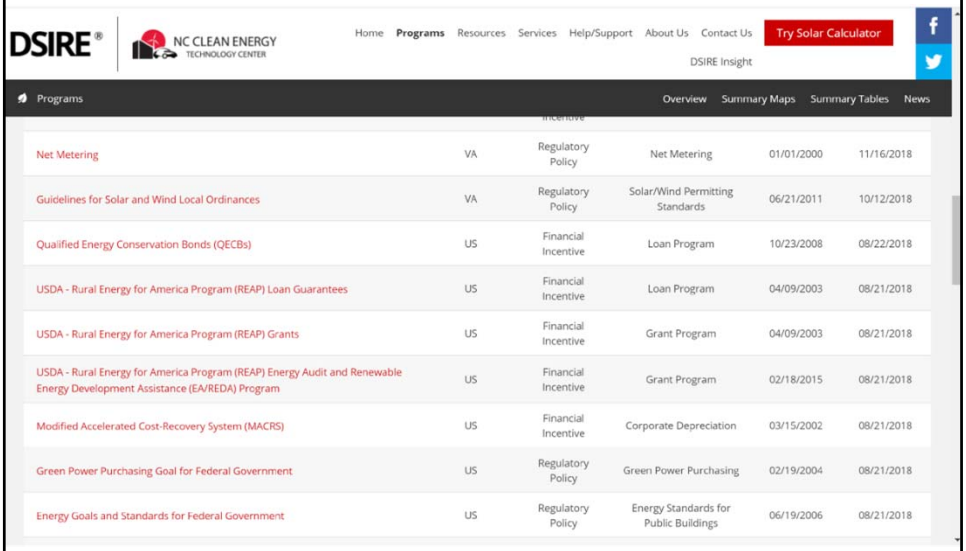
USDA

United States Department of Agriculture
National Institute of Food and Agriculture

University of Maryland · Nebraska · Wisconsin · Rutgers · Virginia Tech · Illinois · Penn State · Michigan State University

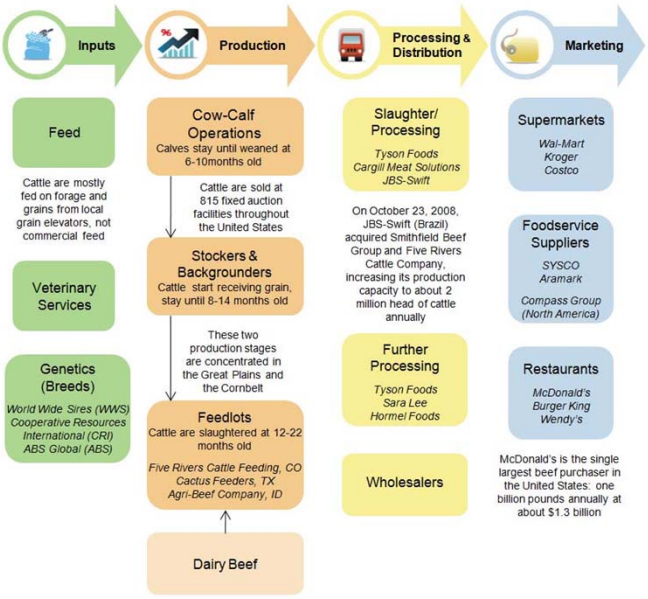
https://farm-energy.extension.org/energy-answers-for-the-beginning-farmer-and-rancher/

Additional Resources



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/



A Value Chain Analysis of the U.S. Beef and Dairy (Lowe & Gereffi, 2009)
Industrieshttps://www.researchgate.net/figure/US-Beef-Industry-Summary-Value-Chain_fig9_294579508

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
- Management Factors
- System Components
- Siting Considerations
- Operator Experiences
- Q&A / Discussion

Presenters
- System Operators: Bob Bagley, North Mountain Cattle Company & Dr. Gabe Pent, Shen Valley AREC/VT
- Virginia Cooperative Extension: Matt Booher, Rockingham/VCE & John Ignosh, Biological Systems Eng. Extension/VT

REGISTER FOR THIS FREE WEBINAR AT THE BELOW LINK:

Project Sponsors

MOUNTAINS-TO-BAY GRAZING ALLIANCE · NFWF · DMME · Virginia Cooperative Extension

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

Introduction · Field Level Analysis · Instrumentation · Leveraging Existing Resources · Design Considerations · Sharing Project Experiences · What is Lidar? · Project Partnerships · Collaborators · References

Virginia Cooperative Extension · VirginiaTech · Biological Systems Engineering

Webinars & Workshops on Energy Project Decision Support Tools

RETScreen Expert — Clean Energy Management Software

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: NRCAN]

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

Featuring 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 Canmet ENERGY and the Advanced Energy Systems Group of the Department of Technical Physics and Mathematics at Alvar 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, modelling, 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* 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.

Virginia Cooperative Extension
Virginia Tech · Virginia State University
www.ext.vt.edu

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:

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
- Assessing System Cost
- Forecasting the Value of Electricity
- Understanding Incentives
- Conducting a Financial Analysis
- 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: NREL)" SAM is a **freely available** decision support tool developed by the U. S. Department of Energy's National Renewable Energy Lab.

SAM Software Interface (source: NREL)

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 13-14, 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 Romich, 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

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(800) 828-1120 during business hours of 8 a.m. and 5 p.m. to discuss accommodations 5 days prior to the event.

Series Collaborators & Sponsors:

DMME · EXTENSION · NREL Biological Systems Engineering

Virginia Cooperative Extension
Virginia Tech · Virginia State University
www.ext.vt.edu

Solar Resource

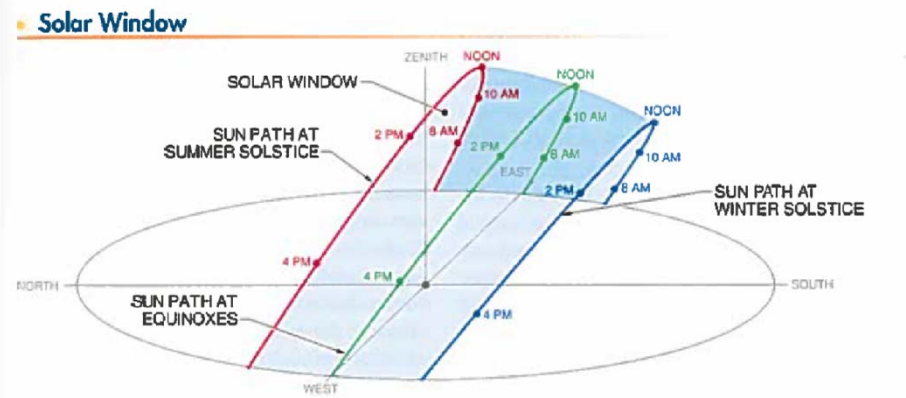


Figure 2-27. *The solar window is the area of sky containing all possible locations of the sun throughout the year for a particular location.*

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

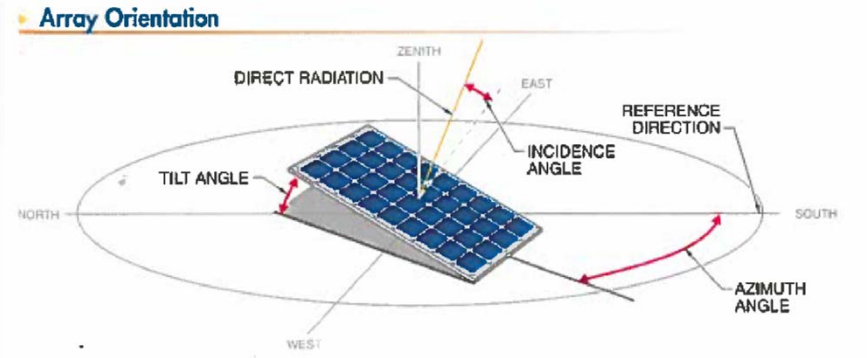


Figure 2-28. *Array orientation can be described using azimuth and tilt angles.*

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 Edtion. NJATC, American Technical Publishers, Inc.

- Irradiance (W/m^2)
- Insolation or Peak sun hours (kWh/m^2/ **day**)

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

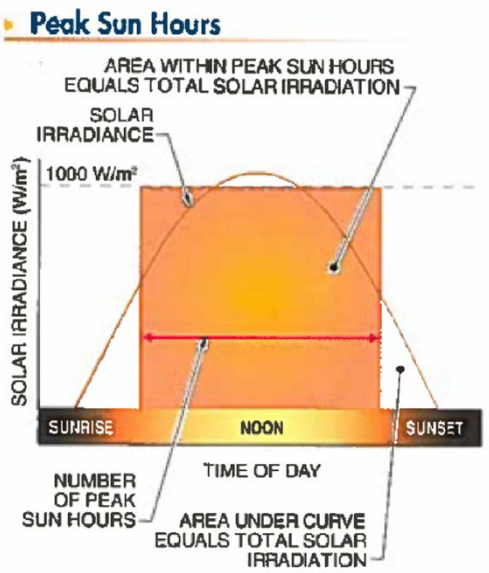
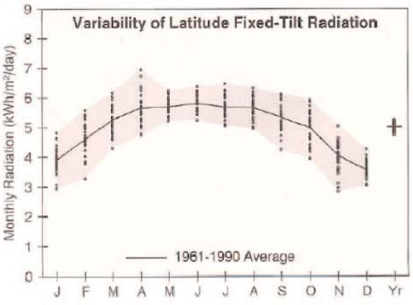


Figure 2-10. *Peak sun hours is an equivalent measure of total solar irradiation in a day.*

Source: 2010. Dunlop, J. Photovoltaic Systems, Second Edtion. 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

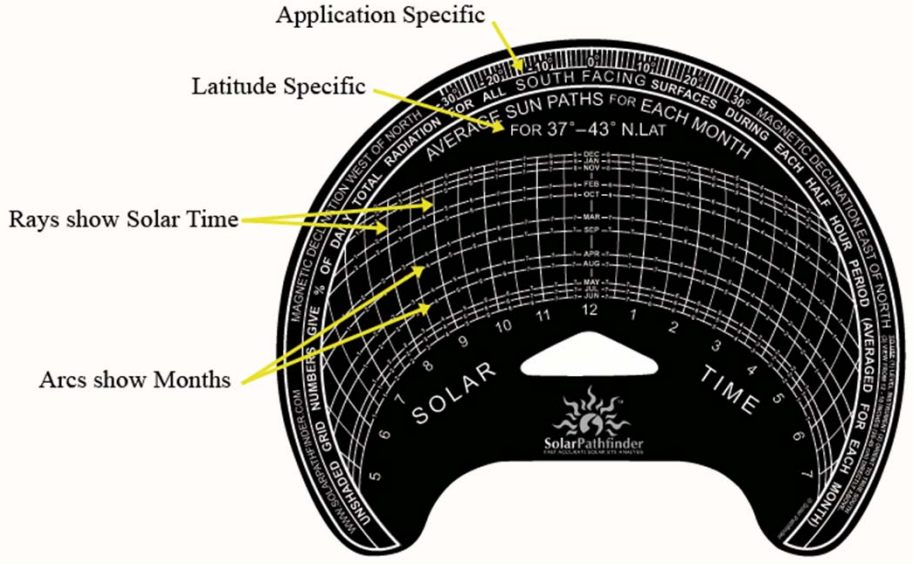
Solar Radiation for Flat-Plate Collectors Facing South at a Fixed Tilt (kWh/m²/day), Uncertainty ±9%

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	4.9/6.5	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	2.7/3.8	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

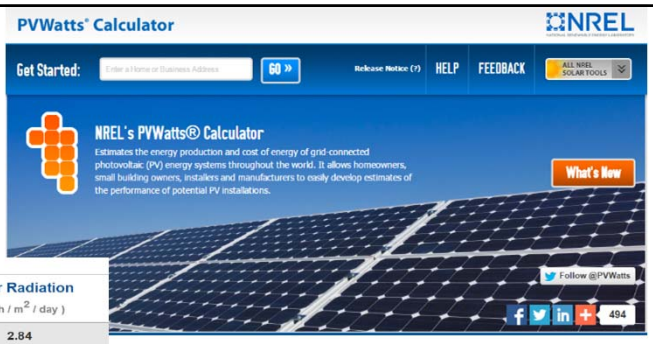
Source: https://www.solarpathfinder.com



https://www.solarpathfinder.com/images/spf/works/big-diagram_labels.png

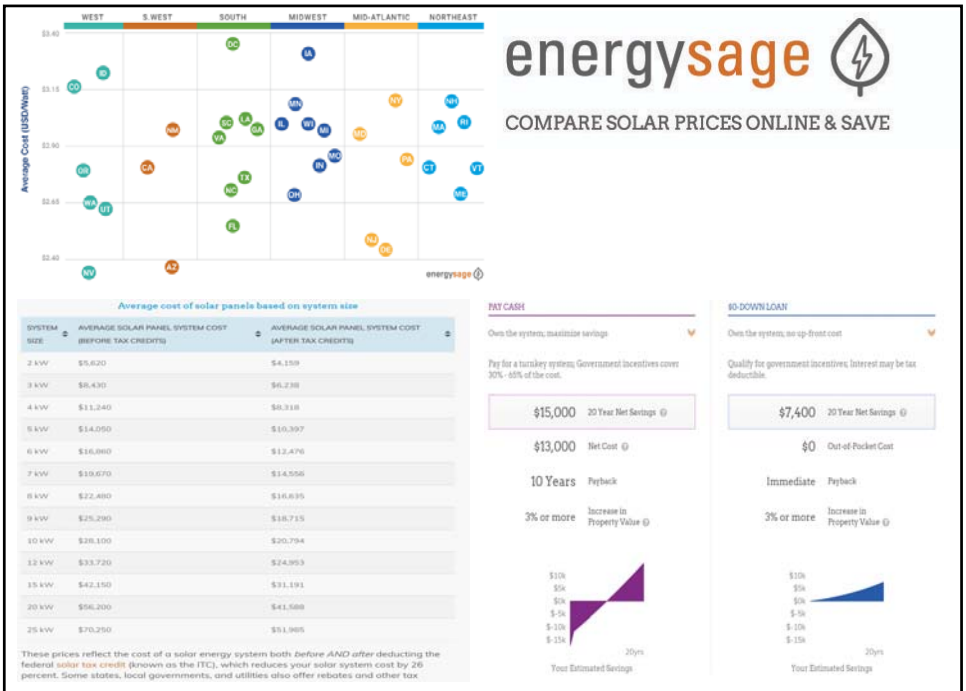
PV WATTS

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://pvwatts.nrel.gov/pvwatts.php



Sources: https://www.energysage.com

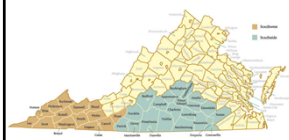
Table 1: Example of Comparing Multiple System Proposals

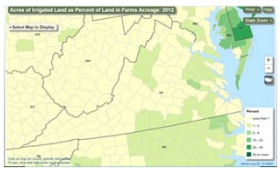
	Proposal 1	Proposal 2	Proposal 3
System Size (kW)	9.848	11.777	7.927
kilowatts to watts	9.848	11.777	7.927
Direct Capital Cost	$16,600	$18,300	$14,600
Indirect Capital Cost	$11,500	$10,900	$13,000
Total Installed Cost	$28,100	$29,200	$27,600
Installed Cost Per Watt (Pre-Incentive)	**2.85**	**2.48**	**3.488**

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

Tobacco Commission Counties
Southside and Southwest





USDA 2013 Irrigation Survey: https://www.agcensus.usda.gov/Publications/2012/Online_Resources/Farm_and_Ranch_Irrigation_Survey/fris13.pdf

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

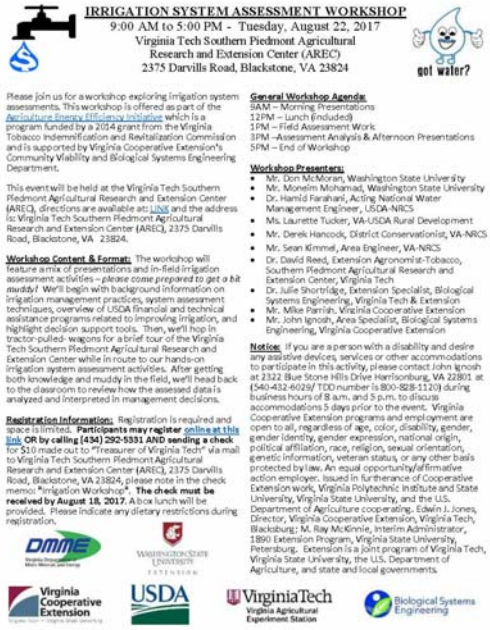
According to a USDA 2013 Irrigation Survey, the AEEI eligible counties of Southside (blue counties highlighted in map below) have relatively higher rates of irrigated land

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

•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 Darvills Road, Blackstone, VA 23824

got water?

Please join us for a workshop exploring irrigation system assessments. This workshop is offered as part of the Agriculture Energy Efficiency Initiative which is a program funded by a 2014 grant from the Virginia Tobacco Indemnification and Revitalization 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: LINK and the address is: Virginia Tech Southern Piedmont Agricultural Research and Extension Center (AREC), 2375 Darvills 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 OR by calling (434) 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 Darvills Road, Blackstone, VA 23824, 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.

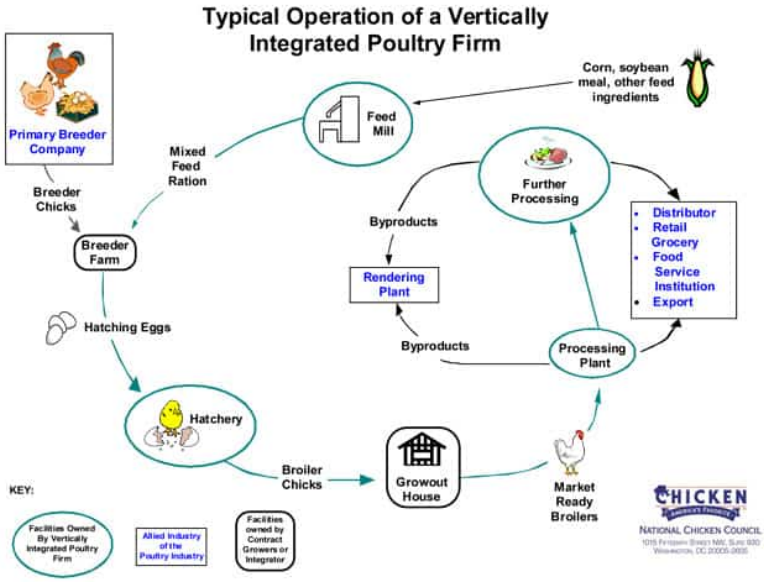
General Workshop Agenda:
9AM – Morning Presentations
12PM – Lunch (included)
1PM – Field Assessment Work
3PM –Assessment Analysis & Afternoon Presentations
5PM – End of Workshop

Workshop Presenters:
- Mr. Don McMoran, Washington State University
- Mr. Moneim Mohamad, Washington State University
- Dr. Hamid Farahani, Acting National Water Management Engineer, USDA-NRCS
- Ms. Laurette Tucker, VA-USDA Rural Development
- Mr. Derek Hancock, District Conservationist, VA-NRCS
- Mr. Sean Kimmel, Area Engineer, VA-NRCS
- Dr. David Reed, Extension Agronomist-Tobacco, Southern Piedmont Agricultural Research and Extension Center, Virginia Tech
- Dr. Julie Shortridge, Extension Specialist, Biological Systems Engineering, Virginia Tech & Extension
- Mr. Mike Parrish, Virginia Cooperative Extension
- Mr. John Ignosh, Area Specialist, Biological Systems Engineering, Virginia Cooperative Extension

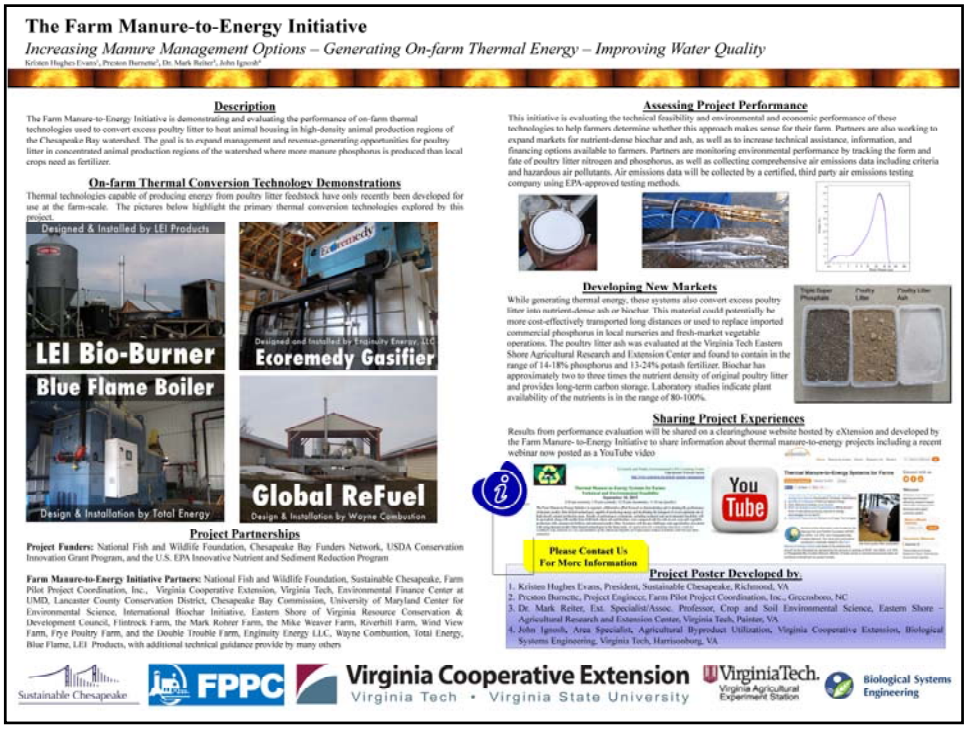
Notice: If you are a person with a disability and desire any assistive devices, services or other accommodations to participate in this activity, please contact John Ignosh at 2322 Blue Stone Hills Drive Harrisonburg, VA 22801 at (540-432-6029/ TDD number is 800-828-1120) during business hours of 8 a.m. 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 McKinnie, 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.

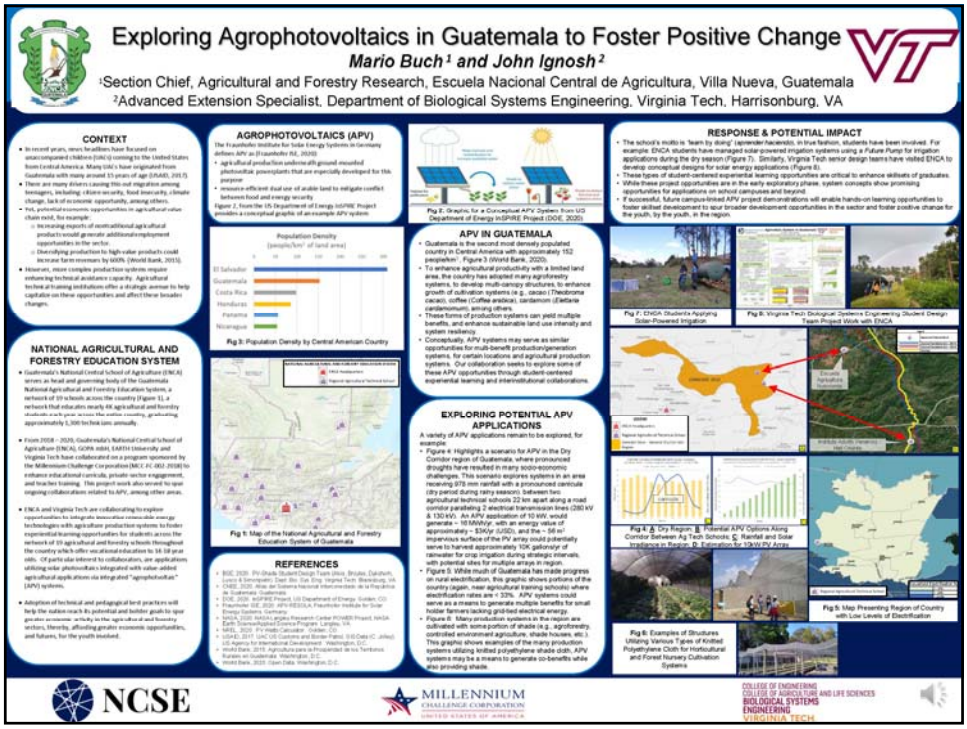
DMME · Washington State University · Virginia Cooperative Extension · USDA · VirginiaTech Virginia Agricultural Experiment Station · Biological Systems Engineering

Project Demonstrations, Short Courses & Field Days



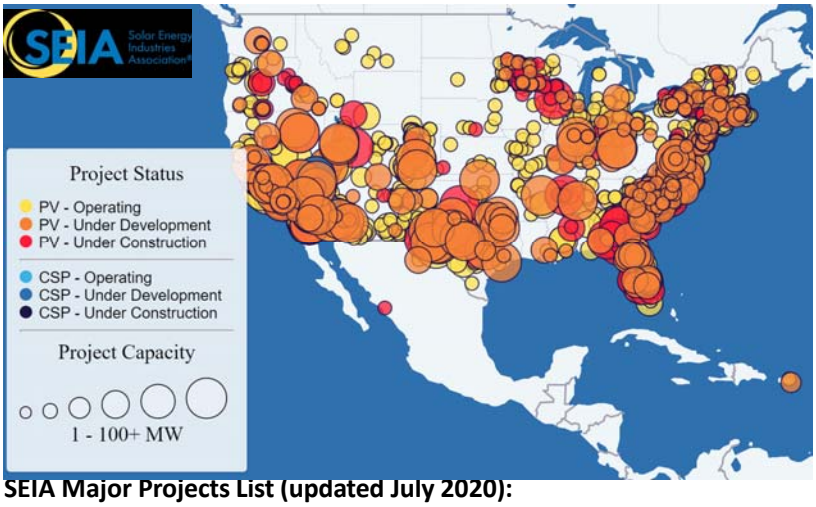
National Chicken Council: https://www.nationalchickencouncil.org/industry-issues/vertical-integration/





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/73wZPcz9c70	Photo Source: 100 kW Grid Interactive Solar PV Perry Street Parking Garage Virginia Tech Blacksburg, VA Video: https://www.youtube.com/watch?v=BG6bmL_QW2Q	Photo Source: SOLAR PV SYSTEMS by Tommy Cleveland, NC Clean Energy Technology Center NC State University Video: https://youtu.be/0k57Di3Cm3o

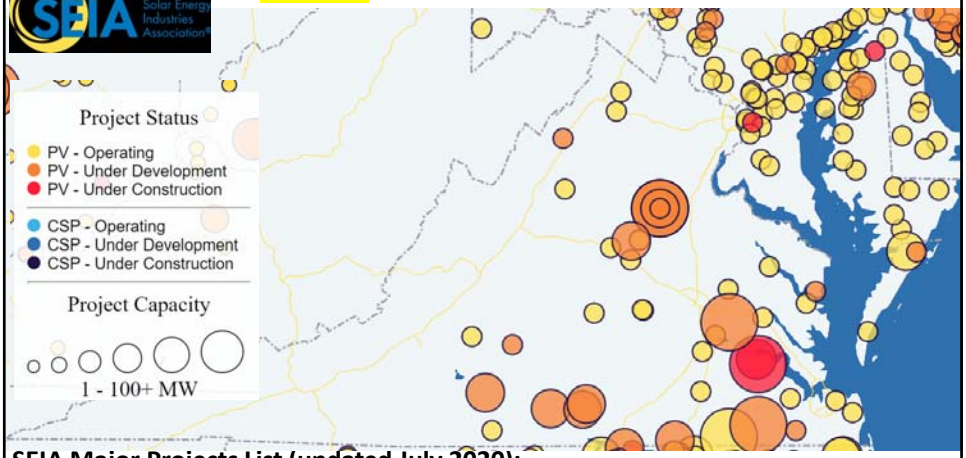


SEIA Major Projects List (updated July 2020):
https://www.seia.org/research-resources/major-solar-projects-list

YEAR: 2016

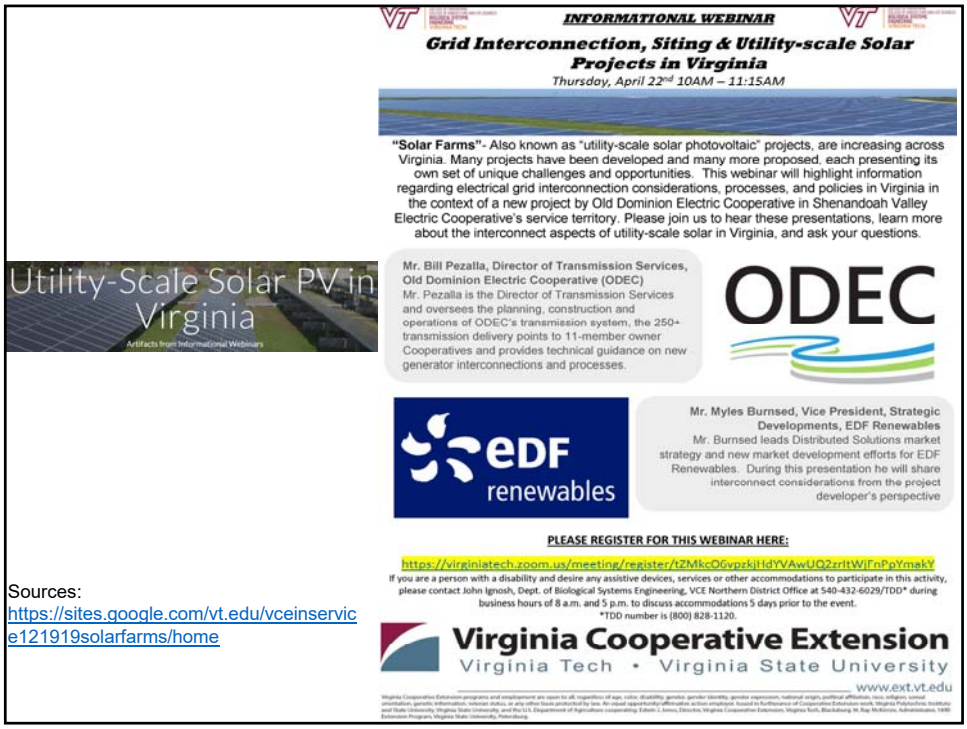
SEIA Major Projects List:
http://www.seia.org/map/majorprojectsmap.php

YEAR: 2020

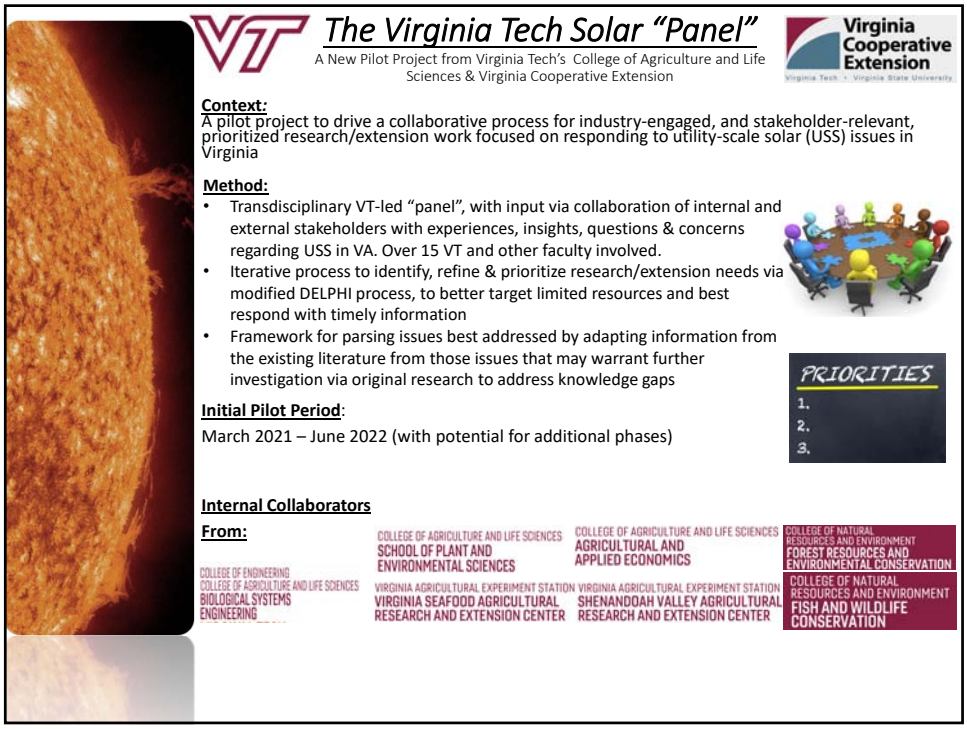


SEIA Major Projects List (updated July 2020):
https://www.seia.org/research-resources/major-solar-projects-list

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



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



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	☐	☐	☐	☐	☐
2. Relevance of content to your requirements	☐	☐	☐	☐	☐
3. Usefulness of activities conducted during the workshop	☐	☐	☐	☐	☐
4. Presenters' knowledge of subject	☐	☐	☐	☐	☐
5. Presenters' style of teaching and communication	☐	☐	☐	☐	☐
6. Presenters' response to doubts and queries	☐	☐	☐	☐	☐
7. Usefulness of handouts at workshop	☐	☐	☐	☐	☐
8. Workshop registration process	☐	☐	☐	☐	☐
9. Overall experience at workshop	☐	☐	☐	☐	☐
10. How worthwhile was the workshop in terms of time and expense?	☐	☐	☐	☐	☐

- 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 fut 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.

	Nothing ◄		Some ⟶		A lot
Overall, how much did you learn from this session?	☐	☐	☐	☐	☐

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

Solar Photovoltaic Investment Analysis & DOE NREL's
'System Advisor Model' (SAM) Decision Support Tool

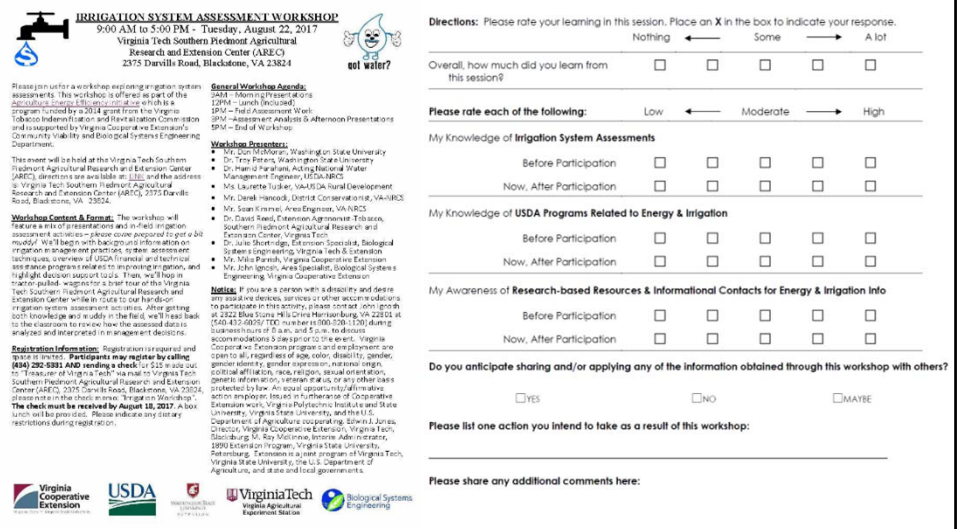
December 13th & 14th 9AM - 5PM
The Institute for Advanced Learning and Research
150 Slayton Avenue Danville, VA 24540

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	★	★	★	★	½
Participants' Awareness of Resources for Solar PV Project Exploration						
BEFORE Workshop	2.67	★	★	½	☆	☆
AFTER Workshop	5.00	★	★	★	★	★
Participants' Knowledge of NREL's System Advisor Model (SAM)						
BEFORE Workshop	2.00	★	★	☆	☆	☆
AFTER Workshop	4.50	★	★	★	★	½

Irrigation Workshop Evaluation Instrument Excerpt



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 Darvills Road, Blackstone, VA 23824

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?	☐	☐	☐	☐	☐

Please rate each of the following:	Low ←		Moderate →		High
My Knowledge of **Irrigation System Assessments**					
Before Participation	☐	☐	☐	☐	☐
Now, After Participation	☐	☐	☐	☐	☐
My Knowledge of **USDA Programs Related to Energy & Irrigation**					
Before Participation	☐	☐	☐	☐	☐
Now, After Participation	☐	☐	☐	☐	☐
My Awareness of **Research-based Resources & Informational Contacts for Energy & Irrigation Info**					
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:

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	★	★	½	☆	☆
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	★	★	★	★	☆

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 Darvills Road, Blackstone, VA 23824

got water?

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

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

Virginia Cooperative Extension
Virginia Tech • Virginia State University